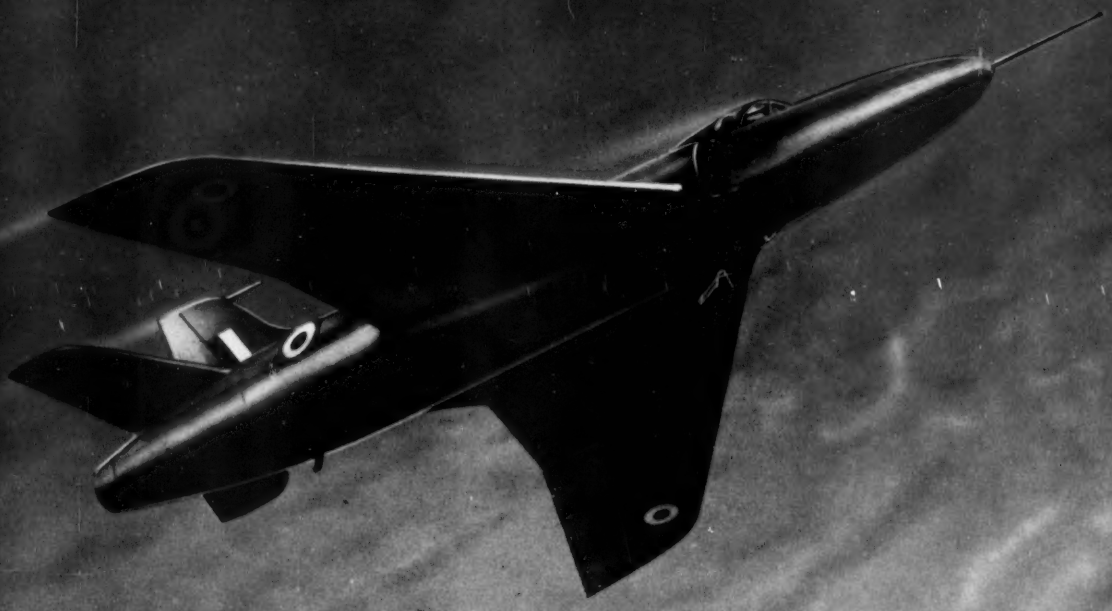
27 JUNE 1952 ONE SHILLING

# FLIGHT

AND AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB



ROTOL

ROTOL

*This gas turbine fuel system control unit relates fuel delivery to air mass flow through the engine, thereby controlling engine accelerations at all altitudes, thus limiting the combustion temperatures.*

**FUEL AND COMBUSTION SYSTEMS FOR GAS TURBINE ENGINES**

**LUCAS**

JOSEPH LUCAS (GAS TURBINE EQUIPMENT) LTD., BIRMINGHAM & BURNLEY, ENGLAND

*Palmer Ribs for safer landings*

Palmer

PALMER RIBBED TREAD AERO TYRES HAVE THESE ADVANTAGES OVER ORDINARY PATTERNED TYRES:

*No heel-and-toe wear* *Ribs don't fling mud*

*Ribs wear longer—more rubber where it's wanted*

*Effective grip on wet runways—flexible ribs act as squeegees.*

RIBS GIVE AS SAFE A WARNING OF WEAR AS PATTERN TREAD

*Service to Aircraft Constructors*

**WHEELS • TYRES • BRAKES • PNEUMATIC RAMS**
**REDUCING VALVES • SILVOFLEX HOSE**

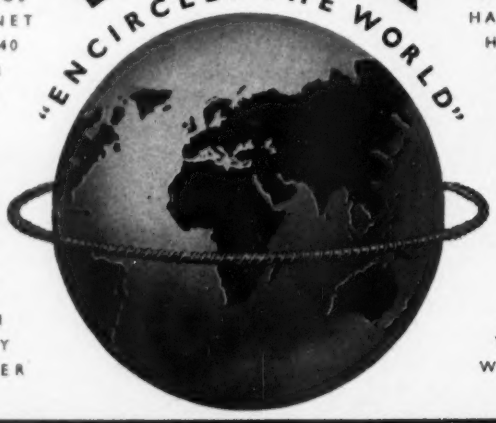
THE PALMER TYRE LTD, PENFOLD ST, EDGWARE ROAD, LONDON, N.W.8

A

ALBACORE · ALBATROSS · ALBEMARLE · ANSON · AMBASSADOR · APPOLLO · ATTACKER · A.W.52
ATHENA · BARRACUDA · BATTLE
BEAUFIGHTER · BEAUFORT
BRISTOL 173 · BUCKINGHAM
BRIGAND · CANBERRA
DEFIANT · FIREBRAND
FULMAR · FREIGHTER
HAMILCAR · HASTINGS
HURRICANE · HORNET
HERON · HAWKER 1040
HAWKER N.7 · LANCASTER
METEOR NIGHTFIGHTER
MASTER · MARATHON
PROVOST · PRENTICE
SEA OTTER · SEAGULL
SEA FURY · SEA HAWK
STIRLING · SOLENT
SUPERMARINE S10
SUPERMARINE 535
TEMPEST · TYPHOON
VARSITY · VENOM
VICEROY · WHITLEY
WELKIN · WAYFARER

BOMBAY · BALLIOL · BISLEY
BLENHEIM · BRABAZON
BOTHA · BUCKMASTER
COMET · DON · DOVE
FIREFLY · FLAMINGO
GANNET · GLOSTER G.A.5
HAMPDEN · HENLEY
HALIFAX · HAWKER 1067
HAWKER 1052 · HERMES
LINCOLN · MARTINET
MOSQUITO · METEOR
OXFORD · PROCTOR
PRINCE · PRINCESS
SPITFIRE · SEAFIRE
SKUA · SEA HORNET
SWORDFISH
SUNDERLAND
VISCOUNT
VAMPIRE · VALETTA
VIKING · WYVERN
WELLINGTON
WESTLAND S.55

TELEFLEX
"ENCIRCLES THE WORLD"



TELEFLEX PRODUCTS LTD · CHADWELL HEATH · ESSEX
TELEPHONE: SEVEN KINGS 5771 (7 lines)
AUSTRALIA · BELGIUM · CANADA · FRANCE · HOLLAND · ITALY · SWITZERLAND · SWEDEN · U.S.A.

*Reach your men at the wheel...*

When emergencies arise . . . when plans are suddenly altered . . . direct two-way contact with your drivers will quickly save delay and confusion. You can be in *immediate* touch with your local transport with a G.E.C. *V.H.F.* Radio Telephone — utterly reliable and as simple to use as a telephone. Here is a new power at your elbow: another scientific aid towards maximum efficiency. The G.E.C. *V.H.F.* Advisory Service will be pleased to show, without obligation, how such a system could be economically installed to help *you*. Why not write to us today?

*Radio telephone equipment backed by all the technical skill and resources of the G.E.C., can be a deciding factor in the efficient control of many airfield mobile services such as Fire Tenders, Ambulances, Servicing Vehicles and Bowsers.*

**with G.E.C. V.H.F. Radio Telephone Equipment**

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

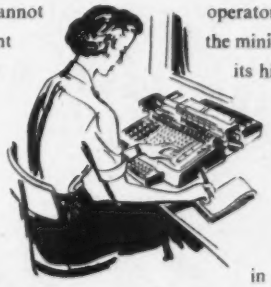
# the economics of AIRPORT RECORDING

From the standards and recommended practices laid down by the Convention on International Aviation, it is evident that automatic recording for Air Traffic Control will sooner or later be expected at every airport. The problem of high costs has hitherto caused natural hesitation on the part of some airport authorities in implementing these requirements. In this series of advertisements, the answer to this problem is dealt with under the three headings of Capital Expenditure, Staff Requirements, Operating Costs.

## OPERATING COSTS

In any airport recording system three factors have a major influence on the cost of operation (1) The recording medium (2) The degree of attention required (3) Ease of maintenance.

A recording medium such as embossed film which, when the recording has served its purpose, cannot be used again is obviously a constant expense. For economy the medium should therefore be non-expendable. Wire answers this requirement but is subject to breakage. The only satisfactory answer is the use of magnetic tape. This is the medium used in the Thermionic Multi-Channel Airport Recorder—an important advance in Air Traffic Control recording efficiency developed by the T.P. Group.



The tape is virtually proof against breakage. Its first cost is low. It can be instantly erased and used again and again. The quantity required is thus dependent only upon the storage period demanded for investigation purposes.

This, however, is only one of the features which make the Thermionic Recorder outstandingly economical in operation. Automatically, for continuous periods of up to 12 hours, it will monitor any number of channels up to a total of 14—recording all on the one tape together with times of transmission.

It needs only the occasional services of one unskilled operator. It cuts down costs of maintenance to the minimum by its extreme simplicity of design, its high degree of standardisation, and by its being built up from a number of interchangeable units which enable it to be accommodated to the exact requirements of each air traffic control centre.

Full details of this latest development in low-cost airport recording equipment will be supplied gladly on request.

**Thermionic multi-channel airport recorder**

*Other products include the Soundmirror Magnetic Tape recorder, the Recordon Magnetic Dictating Machine and a complete range of instruments for electro-acoustical measurements.*

A PRODUCT OF THE TP GROUP OF COMPANIES

**THERMIONIC PRODUCTS LTD., HYTHE, SOUTHAMPTON, ENGLAND**

*Telephone : Hythe 3265*

P.A. 4565

Teddington CONTROLS

# WIND-SCREEN ANTICING CONTROLS

The problems of keeping a wind-screen ice free and providing maximum resistance to shock loads due to bird impact, etc., are both overcome by maintaining a reasonable temperature within the screen. The application of heat to a cold panel, however, is not straightforward, and shattering can occur. Already, this difficulty has been overcome by our controls which, besides holding the temperature within close limits, provide a slow and controlled temperature increase from cold, and cater for overheat conditions due to failure, and thermal shock due to reinstatement after a no-volts failure in electrical systems.

This complete protection is a feature of our wind-screen anticing controller ; we would be pleased to consider your installation.

Teddington

Teddington AUTOMATIC CONTROLS

TEDDINGTON CONTROLS LTD., CEFN COED, MERTHYR TYDFIL, SOUTH WALES. Merthyr Tydfil 666

FOR STOPPING FAST MOVING OBJECTS

Vinten

HIGH SPEED CAMERAS

W. VINTEN LIMITED • NORTH CIRCULAR ROAD • CRICKLEWOOD N.W.2. • TELEPHONE: GLADSTONE 6373

Φ 26

*and now—*

# SEALANDS FOR THE INDIAN NAVY



Fitted with dual controls and long range tanks, and with seating accommodation for six, these amphibians will be operated as communications aircraft, based at Cochin on the western seaboard of Southern India.

Yet again the unique qualities of the Short Sealand justify the selection of this aircraft by the Indian Navy for their varied requirements, and it is quite certain that this sturdy amphibian will undertake its duties, however arduous, without difficulty, just as other Sealands are successfully tackling unusual tasks in many other parts of the world today.

## *THE SEALAND AMPHIBIAN*

Shorts

THE FIRST MANUFACTURERS OF AIRCRAFT IN THE WORLD

SHORT BROTHERS & HARLAND LIMITED
QUEENS ISLAND, BELFAST
*London Office: 17 Grosvenor Street, W.1*

# *The Accepted Design for Aircraft Trimming . . .*

**NOW IN PRODUCTION AND ADOPTED BY THE LEADING AIRCRAFT CONSTRUCTORS**

**A.I.D. and A.R.B. approved**

This trim-switch, which is now in production and adopted by the leading aircraft constructors gives full trim control at all attitudes. Weighing 14 ozs. it is wired for use in connection with actuators incorporating a split series motor.

**SPECIFICATION**

**Weight . . . . . 14 ozs.**
**Nose up Actuator "OUT"**
**Nose down Actuator "IN"**
**Port wing down Actuator "IN"**
**Starboard wing down Actuator "OUT"**

*When ordering please quote part No. L.S.* 1310

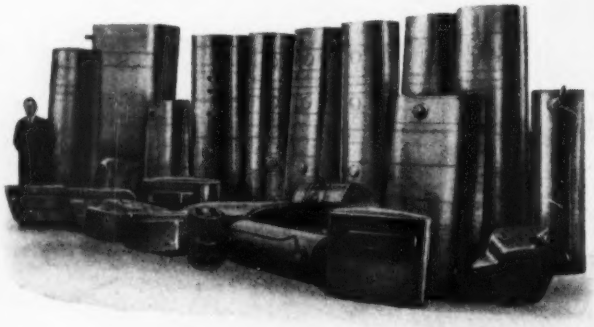
**WESTERN MANUFACTURING (READING) LIMITED**

AIRCRAFT DIVISION · THE AERODROME
READING · BERKS

Telephone : Sonning 2351. 'Grams : "Hawk," Reading

# EVERYTHING IN SHEET METAL WORK

## AND LIGHT ENGINEERING



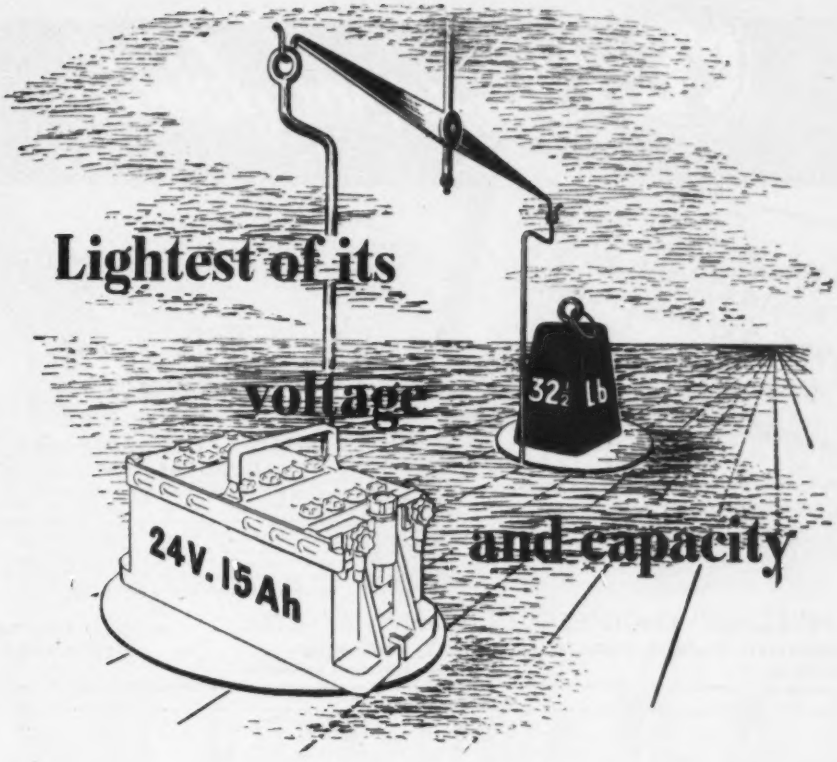
AIRCRAFT
AUTOMOBILE
COACH AND BUS BODIES
Municipal and other ALL-METAL Vehicle Bodies

Refrigeration
COLD STORAGE
HEATING
DRYING
AIR Conditioning
MINING

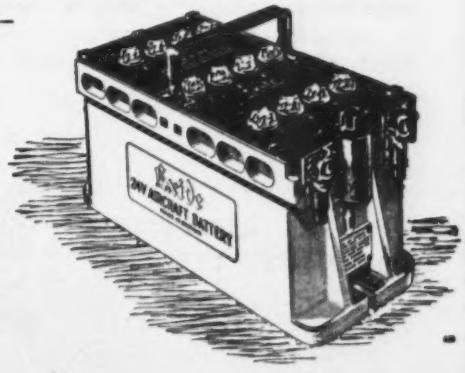
TELEGRAMS: BROMELPAR, SOUTHTOT, LONDON
**161 WEST Rd., TOTTENHAM**

**E. G. Brown & Co. Ltd**

TELEPHONES: TOTTENHAM 2257, 2258 & 2259
**LONDON, N.17**




The Exide 24V. battery is the lightest British civil aircraft battery of its voltage and capacity. That one fact gives it a very sound claim for consideration when batteries are being chosen for aircraft. What else has this Exide battery to offer? Exceptional electrical performance, long-life plates and high current outputs for engine starting. Very advanced design in every detail—but *sound* design, bred from over 50 years' experience of battery manufacture. Not only best because lightest—but lightest *and* best.




# Exide

**AIRCRAFT BATTERY**

**24 V. 15 Ah. 32½ lb. — 24 V. 25 Ah. 43½ lb.**

A PRODUCT OF CHLORIDE BATTERIES LIMITED . EXIDE WORKS · CLIFTON JUNCTION · NEAR MANCHESTER

# ME Universal Joints

**HAVE PROVEN THEIR RELIABILITY FOR OVER TWENTY YEARS**
in all types of aircraft

We also specialize in the production of precision aircraft components, as well as tooling equipment for increased production including gauges of all types, jigs and fixtures, special machines, etc.

## THE *NEW* LIGHT SERIES "HOOKE'S" TYPE

SPECIALLY DEVELOPED FOR THE AIRCRAFT INDUSTRY. For light loads. These joints are made in light alloy with hardened and ground trunnion pins, cadmium plated. Design is based on our standard Hooke's type joint, but dimensions have been altered to suit the bores of standard aircraft tubes. Made in five sizes which can be varied to suit particular requirements.

## THE STANDARD "ME" UNIVERSAL BALL JOINT

UNSURPASSED FOR HIGH PERFORMANCE ON DIFFICULT ANGULAR DRIVES. Simple. Sturdy. Reliable. For heavy loads. These qualities account for the increasing use of ME universal ball joints throughout the aircraft industry. 92 per cent. to 98 per cent. efficient (N.P.L. certified) they are the lightest and most compact ball joints yet produced. Nine standard sizes for shaft diameters of ½ in. to 1⅛ in. Dirt excluding covers available for both types.

**THE MOLLART ENGINEERING COMPANY LTD.**
**KINGSTON BY-PASS, SURBITON, SURREY, ENGLAND**
Tel.: ELMBRIDGE 3383/3/4 'Grams: PRECISION, SURBITON

*Air Ministry Gauge Test House Authority* 89755/31



*Proud to be*

# SERVING FAMOUS FIRMS . . . .

Heston Aircraft have long specialized in the complete design and manufacture of a variety of aeronautical equipment — from simple components to complete aircraft. Leading manufacturers who rely on the service of Heston Aircraft include :—

- **The de Havilland Aircraft Co. Ltd.**
- **Vickers-Armstrongs Ltd.**
- **D. Napier & Son Ltd.**
- **B.O.A.C.**

HESTON AIRCRAFT COMPANY, LIMITED

Heston Airport, Hounslow, Middlesex

...in the

# *part-time* R.A.F.

Much has been said and written about the week-end flyers of the pre-war R.Aux.A.F. and R.A.F.V.R. They and their ground crews — particularly in the tense, uncertain days of the Battle of Britain — helped to make possible our way of life today. To keep this life intact we still need week-end airmen. Why don't you become one of them?

**POST THE COUPON NOW FOR FULL DETAILS OF PART-TIME SERVICE IN YOUR LOCAL UNIT**

TO : ROYAL AIR FORCE (F.R.74), VICTORY HOUSE, LONDON, W.C.2

*Please send particulars of part-time service in the R.A.F. (Applicants from British Isles only)*

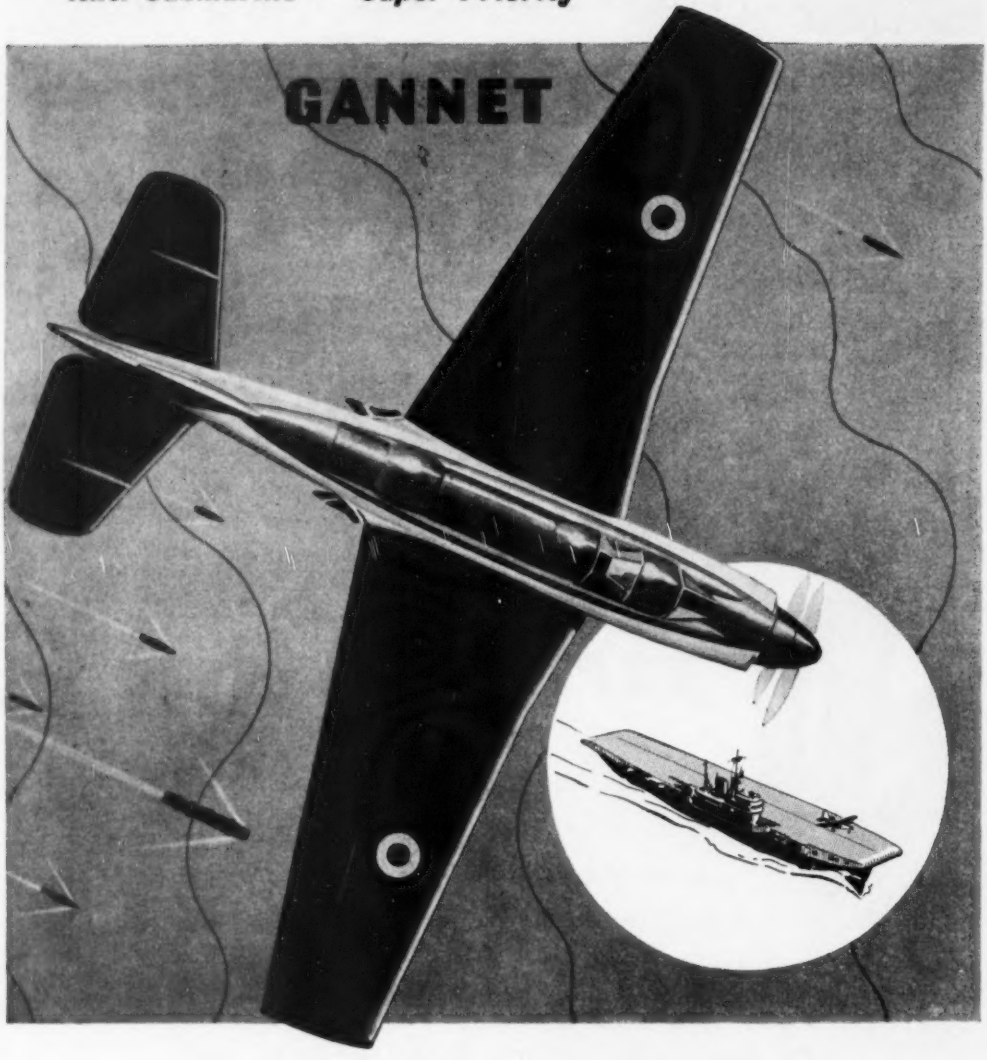
NAME.....

ADDRESS.....

*(If ex-R.A.F. or ex-W.A.A.F. give rank, trade and No.)*

★ IF YOU ARE BETWEEN 14 AND 17—AND KEEN—JOIN THE A.T.C. ★

***Anti-Submarine — Super Priority***




# FAIREY

THE FAIREY AVIATION CO. LTD. · HAYES · MIDDLESEX

FLIGHT
and
AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

No. 2266 Vol. LXI. FRIDAY, 27 JUNE 1952

EDITOR
MAURICE A. SMITH, D.F.C.

ASSISTANT EDITOR
H. F. KING, M.B.E.

TECHNICAL EDITOR
C. B. BAILEY-WATSON, B.A.

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:
DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

*Telegrams, Flightpres, Sedist, London.*
*Telephone, Waterloo 3333 (60 lines).*

Branch Offices:
COVENTRY
8-10, Corporation Street.
*Telegrams, Autocar, Coventry.*
*Telephone, Coventry 5210.*

BIRMINGHAM, 2.
King Edward House,
New Street.
*Telegrams, Autopress, Birmingham.*
*Telephone, Midland 7191 (7 lines).*

MANCHESTER, 3
260, Deansgate.
*Telegrams, Iliffe, Manchester.*
*Telephone, Blackfriars 4412 (3 lines), Deansgate 3595 (2 lines).*

GLASGOW, C.2.
26b, Renfield Street.
*Telegrams, Iliffe, Glasgow.*
*Telephone, Central 1265 (2 lines).*

SUBSCRIPTION RATES
Home and Overseas: Twelve months £3 3s. 0d. U.S.A. and Canada, $10.00
BY AIR: To Canada and U.S.A. six months, $16.

IN THIS ISSUE:

Bridging the English Channel 760
Our American Correspondent Reports . . . 766
Titanium - - - - - 768
Winged Feet for the Troops 771
Sea Hawk - - - - - 772
Design for Zero "G" - 744
World Gliding Championships 776
High-Speed Aerodynamics 778
Air-Transport Policy - 783

## Modernizing Nato

INTO the jargon-ridden councils of the North Atlantic Treaty Organization the strange new shibboleth "off-shore procurement" has been insinuated. This new password to security—already applied to the dollar-purchase of aircraft spares—now takes on a far wider significance by the announcement last week that the U.S. Government is considering the purchase, with Mutual Security funds, of complete aircraft from European member-nations of NATO. "Specific recommendations" for "co-ordinated production of aircraft in Europe to help in meeting NATO requirements" have been called for; and not without justification the belief has gained currency that the British aircraft industry may be deeply concerned in the matters of licensing and production.

Final decisions would be made only after "careful evaluation of the characteristics of European aircraft for operational requirements," but Mr. Fred Anderson, U.S. special representative for the Mutual Security Agency, is reported to have said in Paris that the U.S.A.F. would be free to choose any aircraft judged to be as good as, or better than, American types. He is further credited with the remark that the machines most likely to be selected were such day fighters as the Hawker Hunter and the Dassault Mystère, the night and all-weather Gloster G.A.5 delta, and the Vickers Valiant jet bomber, adding that the military possibilities of the de Havilland Comet would not be overlooked. Unofficially it is reported that the building of Avon-powered English Electric Canberras for Europe, under "off-shore" contracts, has been under discussion for some time.

With the qualities of the purely military types mentioned the U.S.A.F. has already familiarized itself, and it would be surprising indeed if machines such as those named were not to be chosen on their demonstrated merits to play the leading part in this momentous project. Similarly, of course, British power units—the Rolls-Royce Avon, Armstrong Siddeley Sapphire and Bristol Olympus among them—command the most urgent consideration by the appointed authorities.

## Fuel in Emergency

THERE was a time, a few weeks ago, when the fuel supplies of the world's airlines were threatened, and those concerned with producing and supplying petrol realized how easily the whole air-transportation network might have been paralyzed. Fortunately, reason and wise council seem to have prevailed, and such a calamitous stoppage was averted.

Since the Abadan lunacy, which deprived many countries of their liquid fuels, many families of their livelihood, and Persia of a vital source of revenue—all to achieve nothing—the world's airlines (and particularly the European ones) seem to have been living on a hand-to-mouth basis. When we say it is intolerable that, as a result, the nations of the world can in effect be held up to ransom by a relatively small body of men who now produce the alternative supplies of petrol, we imply no criticism, or otherwise, of the oil men of California. Fortunately, the Middle East is fast making good the oil flow lost from Abadan, and the occasion may never again arise.

Even so, it would be as well, we believe, to have a fair and acceptable rationing system worked out in readiness should restriction again become necessary for a short or long period. Last time, high-octane petrol was supplied to companies on the basis of a percentage of the previous month's consumption. The international operators mostly complained that this was unfair because consumptions were subject to marked seasonal fluctuation, one month's needs being quite different from those of the next. The private operators had even more justification for complaint—for their operations fluctuate widely from week to week—and rationing on the basis of a previous month might debar one or more of the companies from accepting their most important commissions of the year.

Until the new Government works out ways of giving the "independents" some security in the services they are permitted to operate, they, in particular, must at least be saved from further serious difficulties in the form of unfair fuel-allocations.

# BRIDGING THE ENGLISH CHANNEL

## *Growth of the Silver City Car Ferry: Ambitious Re-equipment Plans*

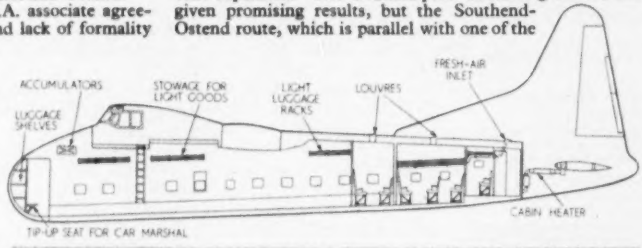
**IN less than four years, the cross-Channel car ferry operated by Silver City Airways has developed into one of the most impressive air-freighting operations in the world. The company's Bristol Freighters have now carried well over 20,000 vehicles between England and France—13,000 of them in 1951. High standards of safety, regularity and service have been established, and Silver City look forward to a continuing expansion of traffic for many years to come. In widening the air bridge, they intend to supplement—and eventually replace—the present freighter fleet with newer Bristol 170s (specially developed for the ferry), larger, four-engined transports and, finally, helicopters. These ambitous plans, evolved mainly by A. Cdre. Griffith Powell, Silver City's managing director, are discussed in this article, which also traces the development of the ferry from the outset.**

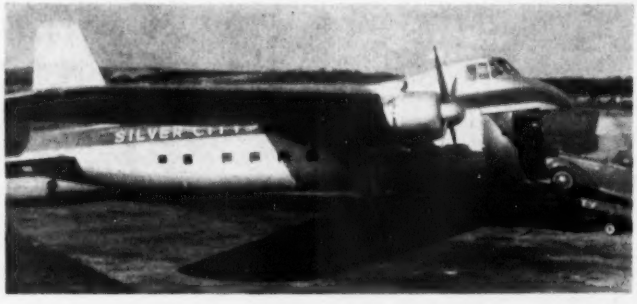
THE first scheduled car-ferry flight was made by Silver City on July 14th, 1948, between Lympne and Le Touquet; this route has remained the "bread-and-butter" service ever since. Only 170 cars were carried in the 1948 season, but useful experience was gained—not only in loading cars and operating aircraft—but in making the necessary documentary arrangements with the R.A.C. and A.A.

Two Freighters worked the route in 1949, carrying 2,700 cars between them. The total went up to 3,850 cars in 1950, together with 1,000 motor cycles and other vehicles, and 15,000 accompanying passengers. Greatly encouraged by the growing popularity of the service, the company estimated that by 1953-4 the annual car-traffic would be nearly 7,000. This target was, in fact, reached in 1951; the fleet of three Freighters had to be doubled to carry over 13,000 vehicles across the Channel. At the peak period of this record year, the six aircraft sometimes made 42 return crossings per day. As the Lympne to Le Touquet route was being worked almost to saturation point (60 return crossings daily by a six-Freighter fleet is thought to be the limit under present conditions), the company began to investigate other short Channel crossings. The outcome of their search was the inauguration, early this year, of air-ferries between Southampton and Cherbourg and Southend and Ostend.

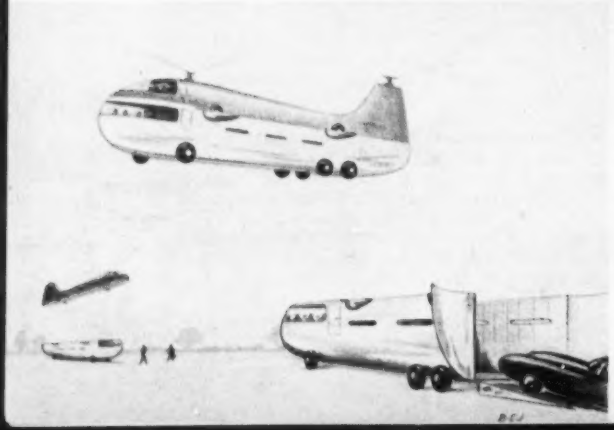
All three services operate (under B.E.A. associate agreements) on the same lines, with speed and lack of formality as the keynote. Passengers arrive in their cars half-an-hour before take-off to enable the vehicles to be cleared through Customs. The Freighters normally carry two cars, loaded in as short a time as two minutes by company drivers, and up to 12 passengers, who ride in a sparsely furnished but not uncomfortable cabin aft of the main car compartment. At the grass airfield of Lympne, for example, about two minutes are spent in taxying and engine-running before the Freighter takes-off and climbs on course to 1,500ft, where power is reduced for cruising at a little over 150 m.p.h. The yellow sands of Le Touquet are soon in view, and touch-down is normally about 18 minutes after take-off. Two minutes' more taxying bring the chock-to-chock time for the 47-mile stage-length to 22 min. Silver City are seeking ways of reducing the number of engine-running hours annually wasted on the ground, and favour a proposal to use self-drive ramps capable of carrying cars out to the aircraft, which could then remain almost in take-off position while awaiting a new load.

Both the Southampton-Cherbourg and Southend-Ostend routes (88 miles and 100 miles respectively) are normally flown in about 35 minutes. This year the fortunes of all three services have been affected, in varying degrees, by the reduction in the overseas-travel allowance. Recent figures showed the Lympne to Le Touquet traffic to be 14 per cent less than last year's total for the same period (sea-ferry traffic is estimated to have dropped by 30 per cent). The end-of-season total is expected to be equal to that for 1951 (13,000 vehicles), but Silver City had hoped for a 15-20 per cent expansion. The Southampton-Cherbourg service has given promising results, but the Southend-Ostend route, which is parallel with one of the

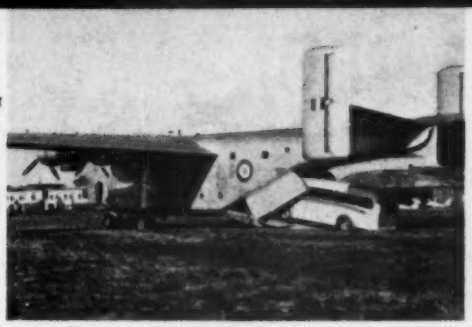



*The upper illustration shows, for the first time, the layout of the six "long-nosed" Bristol Freighters ordered by Silver City Airways. The fuselage has been lengthened by 4ft 10in—permitting three cars and 20 passengers to be carried, instead of two cars and a dozen passengers—and fin area adjusted accordingly. Below it, for comparison, one of the standard Freighters is pictured unloading at Le Touquet.*



*This "Flight" copyright drawing is intended to show the main principles of the "crane-and-pod" helicopter which Silver City hope to introduce by 1960. Such an arrangement would permit the cross-Channel stage-length to be reduced to 22½ miles; the lifting units would be airborne almost throughout the day, pausing only to pick up and deposit the pre-loaded "packing cases" containing cars and passengers.*



*An ideal vehicle for car-ferry operations over slightly longer stages would be the Blackburn and General Aircraft Universal Freighter; civil application of this 162ft-span transport, however, is uncertain.*

*The potentialities of the Bréguet 76-3 Provence are at present being studied by Silver City. Power-units of this 140ft-span freighter are P. and W. R-2800s; fifteen examples have been ordered to date.*

best sea ferries, may be temporarily abandoned; the company still feel, however, that the route has good prospects from a long-term viewpoint.

Most of the cars carried by the ferries belong to holiday-makers, and the traffic is consequently seasonal (for this reason, major servicing must, whenever possible, be carried out in winter). Charter flying of a very varied nature helps the company to increase utilization. Most of the new British cars exported to the Continent are carried by Silver City—enabling at least one Paris distributor to promise 24-hour delivery of any model. Huge quantities of Normandy cheese are flown to England *via* Cherbourg, and livestock were a good source of winter revenue until outbreaks of foot-and-mouth disease restricted movements.

Until last week, the Silver City fleet consisted of eight Bristol Freighters; it has now been augmented by the Freighter formerly kept by B.E.A. for air-lifting powerplants to foreign airports at short notice. This responsibility now falls to the new operators.

Six more Freighters—of a completely new design, illustrated here for the first time—are due to join the fleet next spring. The "Ferry Freighter" was re-designed by the Bristol Aeroplane Company to the specific requirements of Silver City. Its main distinguishing feature is a longer nose (extending the freight compartment to 37ft, and enabling up to three cars and 20 passengers to be carried). Maximum load of the standard machines is two cars and 12 passengers. The long-nose Freighter will have a new fin-and-rudder configuration affording extra side-area, shorter oleo legs to retain the door-sill level of the standard Freighter and 2,090 h.p. Hercules 732 engines instead of 1,690 h.p. series 672s. The first of the new Freighters will, it is hoped, be ready in time for September's S.B.A.C. Show, and Silver City look forward to deliveries at the rate of two per month during March, April and May, 1953. The contract for the six aircraft was valued at £540,000, of which some £90,000 represented the cost of development. The total fleet of 15 Freighters is expected to be big enough to cope with traffic expansion in any direction within the next three years. By 1955, however, Silver City think they will be ready to approach longer-stage ferrying—preferably between London and Paris—if they can obtain suitable aircraft. The requirement would be for a four-engined type with a capacity for six to eight cars and an economic performance over a route of some 175 miles (the terminals tentatively proposed by Silver City are Gatwick and Cormeilles, just north of Paris). On this longer route, the company would like to use three Blackburn and General Aircraft Universal Freighters. But no orders for this promising pantechnicon have materialized so far, and if only three Universals were built, the cost-per-unit would obviously be outside the pocket of any private airline. If no R.A.F. contract is placed for the Universal Freighter, the chances of its appearing in the colours of Silver City or any other independent company are slim.

In the circumstances, S.C.A. have also investigated the possibility of using the Bréguet Provence, a four-engined passenger-cargo transport with a "double-deck" fuselage of capacity comparable with the Universal Freighter's. The Provence is in limited production, but, even so, the unit cost would be very high. A British operator would probably specify four Hercules engines in place of the R-2800 Pratt and Whitneys fitted to current production models for Air France and Air Algerie.

As envisaged by A. Cdre. Powell, Silver City's re-equipment programme involves three stages: the first, introduction of the long-nose Freighters, is now in sight; the second, purchase of four-engined machines if prices permit would, ideally, take effect in 1955.

The third stage would be the introduction of helicopters in 1959 or 1960. Silver City's older Freighters will then be ripe for retirement—and the helicopter is generally expected to replace fixed-wing transports on many shorter-haul routes within, at most, ten years. The company is confident that a suitable helicopter will be developed, and has already surveyed the Channel coastlines of England and France. The airstops—or "helidromes"—provisionally chosen are, on the English side, a point at sea-level on the Kent coast between Dover and Folkestone, and, in France, "a piece of land near Calais." Flying distance between the two points is 22½ miles—less than half the Lympne-Le Touquet route.

The helicopter would be nothing more or less than a self-supporting, self-driven crane, capable of picking up and depositing pre-loaded "pods" on both sides of the Channel without itself landing. The principles of the S.C.A. scheme are apparent in the adjacent diagram. The "crane," or prime mover, would be powered, preferably, by two Hercules engines mounted fore and aft and driving separate rotors. The "pod" would carry two or three cars and a number of passengers (in a separate compartment). Pods would obviously be available in larger numbers than cranes, enabling them to be pre-loaded, cleared by Customs and positioned for pick-up. Utilization of aircraft would thus be very high.

It should be stressed that only the elemental features of this ambitious helicopter scheme are discussed here; a number of practical difficulties would have to be faced and overcome. But the idea is appealing in its simplicity, and manufacturers approached by Silver City to date have expressed keen interest rather than incredulity. The sponsors themselves claim that the scheme embodies nothing which is not technically feasible today, and that it is fully justified by the success of the fixed-wing ferry service so far.

Again, the question of cost arises. The company is not large enough to sponsor construction of a completely specialized helicopter, but A. Cdre. Powell is confident that the S.C.A. requirement will overlap those of several other operators. The chances are that Silver City will obtain a suitable adaptation of one of the large military or civil helicopter projects now under way in Britain. B.E.A.'s specified 40-passenger machine is one example of the projects which point to an important future for rotating-winged aircraft. The "pod" principle is not new, of course; in America, the Fairchild company has successfully modified the design of its familiar twin-boomed Packet to enable the main cargo hold to be detached within minutes, and the Pack Plane, as this version is styled, to fly off without it. The principle has been proved, and there is no reason why a British company should not be among the first to apply it. Silver City show commendable determination to use every modern means of exploiting the short-range ferry services which they have pioneered with such success. The company's long-term plans extend far beyond the English Channel, and the eventual aim is to reach a high frequency of operations all the year round by moving aircraft from country to country, season by season, whenever an opening appears.

# FROM ALL QUARTERS

*MALTA BOUND: Firefly 5s of No. 821 Squadron (Lt. Cdr. J. R. N. Gardner, R.N.) leaving Lee-on-Solent last Monday for Malta, where they are to be embarked in H.M.S. "Glory." On the following day the Sea Fury 11s of No. 801 Squadron (Lt. Cdr. P. B. Stuart, R.N.) made the trip for the same purpose. Before departure the crews were addressed by the Flag Officer Air (Home), Vice-Admiral Charles E. Lambe, C.B., C.V.O.* "Flight" photograph

## A Month of Manœuvres

DURING the past few weeks several international air, naval and military exercises have taken place, each involving the Allied Air Forces Central Europe. Although on quite a large scale, they have chiefly been designed to iron out detail problems and so smooth the way for very extensive manœuvres due to take place later this year.

From June 2nd to 6th, "Bluebird" was sponsored by the C.-in-C. Netherlands Home Station to examine naval support for the Central Europe Army. "Javelin III," from the 4th to the 10th, was a B.A.O.R. exercise, the British 11th Armoured Division being supported by units of Air Marshal Sir R. M. Foster's recently formed 2nd Allied Tactical Air Force.

A similar unit, Maj-General Dean Strother's 4th A.T.A.F., held their fortnightly exercise under the code-name "Martini" on the 4th and 18th. Scramble and intercept procedure, G.C.I. and control and reporting was examined and aircraft and personnel changes took place between U.S. and French units. "Barricade," on the 11th, was a regular French air-defence exercise, while "Barrage," on the following day, was a twice-monthly air-defence manœuvre involving integrated action by units from Belgium, Holland, N.E. France and S.E. England.

"Castanets," from June 18th-26th (see page 785) was a combined NATO marine exercise for Channel, Home and E. Atlantic fleets, with A.A.F.C.E. aircraft used offensively and defensively. This manœuvre merged into "June Primer," the climax of the month's exercises, which started last Monday and was due to finish yesterday, June 26th.

"June Primer" has been timed to coincide with "Bullseye," R.A.F. Bomber Command's periodic night operation; "Barrage," previously mentioned; and "Skyscraper," the trial daylight bombing by the U.S. 7th Air Division from Great Britain, with B-45s. The greater proportion of the powerful jet offensive forces needed for "June Primer" came from R.A.F. Fighter Command.

## The Baltic Affair

THE Swedish Ambassador in Moscow has been instructed to inform the Soviet Government that laboratory tests in Stockholm show that the missing Swedish Dakota, for which the Swedish Catalina shot down in the Baltic on June 16th was searching, was itself subjected to "shooting" before it crashed. "In view of this," runs a Swedish Government note to Russia, "the Swedish Government would inquire of the Soviet Government whether Soviet fighting forces fired at the Swedish aircraft, and in the event of an affirmative reply, under what circumstances did this take place?"

The Swedish Defence Minister stated in Stockholm last Sunday that the laboratory tests had confirmed "earlier smouldering suspicions" as to the Dakota's fate. Contrary to Russian assertions that the searching Catalina had fired on Russian fighters, the Minister said that it was not armed and could not have been armed.

## Promising Combination

AUSTRALIA is undoubtedly "on to a good thing" with the Avon-Sabre, tooling-up for which is now proceeding at the Commonwealth Aircraft Corporation plant at Lorimer St., Port Melbourne. During his recent visit to the factory, Lord Hives, managing director of Rolls-Royce, Ltd., expressed great confidence in the ability of the Australians to manufacture the "advanced mark" of Avon which is destined for this fighter. He hoped there would, one day, be as many varieties of Avon as there were of the Merlin.

The Avon-Sabre will, it is reported, be a development of the F-86E. Changes include a four-20 mm armament (pleasing news for Major Jabara, U.S.A.F., who, in a *Flight* interview last March, admitted that he "would trade the Sabre's six 0.5 in guns for four 20 mms") in addition to the great increase in thrust. Unchanged, however, is the American instrument panel. This appears to be a retrograde step in comparison with the standardized instrumentation of British aircraft. Nevertheless, with the finest turbojet in service allied to the best fighter airframe in service, this project appears likely to repeat the success of the North American/Rolls-Royce Mustang.

## The Britannia: and a Freighter Project

DURING his recent visit to Australia—undertaken partly in connection with guided-missile work at Woomera—the joint managing director of the Bristol Aeroplane Co., Mr. W. R. Verdon Smith, gave some interesting tit-bits of news. The first prototype of the Britannia, he said, was expected to fly this month, and he added that, in service, these aircraft were initially intended for the London-Sydney and Sydney-Auckland routes. Less definite was his reference to "a new freighter project," with which Bristols were going ahead. No details of this aircraft could be given but, said Mr. Verdon Smith, "it is a project for which we have considerable hopes."

## Col. W. C. Devereux

BY the death of Col. W. C. Devereux, C.B.E., F.R.Ae.S. (which occurred suddenly on Saturday last—he had been taken ill while visiting the Ascot race meeting) the aircraft industry loses an outstanding figure whose recognition of the value of research, particularly in the field of light-alloy metallurgy, had brought tangible and valuable results over a period of many years. At the time of his death he was managing director of Almin, Ltd. (Farnham Royal, Bucks), and chairman of a number of associated companies, including International Alloys, Renfrew Foundries, Warwick Production Co., Southern Forge, and Structural and Mechanical Development Engineers.

*Col. W. C. Devereux.*

Born in 1893, Wallace Charles Devereux was educated at King Edward Grammar School, Aston, where, thus early, his engineering ability became apparent; and he was still in his early twenties when he was appointed to the responsible post of Superintendent of No. 1 National Aircraft Factory during the 1914-18 war. His study of airframe and engine design during this period, and in the years immediately following the war, convinced him of the possibilities of forged light alloys, in which, with the increasing use of all-metal aircraft, designers were beginning to show interest. In 1927 he founded High Duty Alloys, Ltd., at Slough, with a small but well equipped laboratory, foundry, and machine shop. Much of the early work was on Y-alloy and also on "DU," from which Hiduminium was developed.

The company prospered and expanded, and when the Second World War broke out it was in a position to make a valuable contribution to Britain's aircraft-production effort. Col. Devereux

himself placed his knowledge at the Government's disposal, and was appointed Director of Forgings and Castings at M.A.P. In 1941 he was made Controller of North American Aircraft Supply, in which post he was responsible for the reception, assembly and repair of American airframes and engines.

When war ended he returned once more to the metallurgical research side of engineering, and among his enterprises was the founding of the Fulmer Research Institute at Stoke Poges. He also founded, in 1945, the Associated Light Metal Industries Group.

Aside from his engineering work, Col. Devereux was a keen farmer, and his inquiring mind led him to make some important advances in methods of, for example, grass-drying and cattle-breeding. He was a Fellow of the R.Ae.S. and, this year, was elected vice-chairman of the R.Ae.C.

## Sir Lindsay Scott

THOUGH best known in recent years in the field of archæology, in which he was a distinguished worker, Sir Lindsay Scott, K.B.E., D.S.C., F.S.A., whose death occurred last week at the age of 60, had influential connections with aviation between the two world wars and during the second.

Shortly after the first war—in which he served with the R.N.V.R. in minesweepers, receiving the D.S.C.—he joined the Air Ministry, and held a number of administrative posts in it during the inter-war years.

When the Ministry of Aircraft Production was formed in 1940, he received an appointment there as Second Secretary. This was during the memorable period when Lord Beaverbrook was in command of the battle for production, and it was part of Lindsay Scott's duties to keep the Ministry's internal mechanism running smoothly under the high-pressure power input from its dynamic chief. His valuable work at this time earned him, in 1942, his knighthood.

When M.A.P. was absorbed into the Ministry of Supply at the end of the war, Sir Lindsay continued in his post for a short time, and then retired from the Civil Service in order to devote the whole of his time to archæology. He subsequently held office in a number of learned societies concerned with this science.

## "Unrealistic" Searchlight Training

MR. GEORGE WARD, Under-Secretary of State for Air, was asked in the Commons on June 11th to specify the types of aircraft used for night training co-operation with searchlights; and at what speeds they normally flew when engaged on these duties. He replied that Beaufighters, Oxfords, Proctors, Rapides, Geminis, Ansons, and Consuls were used for this work, on which they flew at speeds ranging from 125-200 m.p.h.

Mr. Ian Harvey (Con., Harrow E.) wondered if this training was really very realistic, particularly when many of the men who were training in this way had actually served under operational conditions. It was hardly likely, he thought, to increase their enthusiasm.

Mr. Ward replied that additional squadrons could not be spared for searchlight co-operation because all available flying hours were taken up on normal interception and all-weather training. Searchlight co-operation training was not regarded as useful nowadays, because the use of searchlights to help fighters in interceptions had been replaced by radar.

## The Herr Doktor Dogmatizes

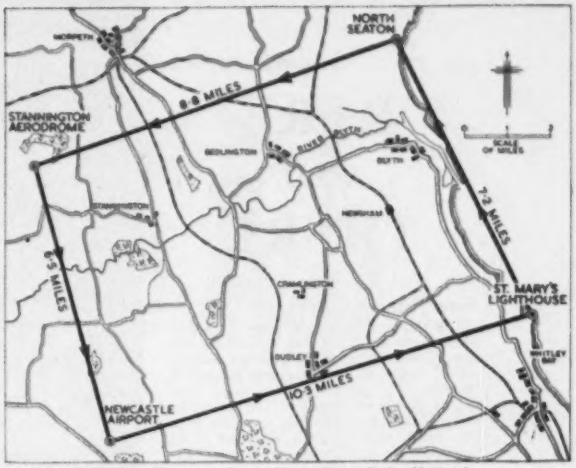
ACCORDING to Dr. G. J. Sissingh—German helicopter expert—as reported in a Washington interview, Britain is behind in helicopter development and her military leaders are "simply not interested"; they believe that the United States will supply helicopters should the need arise. "There is no future in helicopter development anywhere except in the United States," he declared.

Dr. Sissingh, who worked after the war in the helicopter department of the Royal Aircraft Establishment at Farnborough, has been in the United States since last autumn and is now chief of aerodynamics at the Kellett Aircraft Corporation, Camden, New Jersey.

Germany was well ahead of other countries in helicopter development at the end of the war, he said, because the Reich Government made ample funds available for research. None of the German helicopter experts went to Russia after the war, but German developments had had a considerable influence upon U.S. progress.

Dr. Sissingh claimed that Germany flew the first jet-propelled helicopter—brought to America after the war—and, in 1938, four years ahead of the U.S.A.—the first intermeshing-rotor design.

Of the future, he believes that the solution of remaining stability problems will make the helicopter suitable for general instrument-flying and night-flying in about two years' time.




*KING'S CUP COURSE: The circuit for the King's Cup and other National Air Races, to be flown from Newcastle-on-Tyne Municipal Airport on July 11th and 12th. Forty-three entries—a preliminary list of which was given in "Flight" of May 30th—have been received.*

## Mr. J. Albert Thomson

WE regret to have to record yet another death—that of Mr. J. Albert Thomson, LL.D., J.P., chairman and managing director of Brown Brothers (Aircraft), Ltd., the well known London suppliers of aircraft parts. After several months of illness, Mr. Thomson passed away peacefully in his sleep on June 20th, at the age of 72.

## Father Sets the Pace

MR. MAX CONRAD, of Minneapolis, is the father of ten children, the first six of whom can fly. But, said their father, "they think of nothing but cowboys. I'm trying to get them air-minded." And, in pursuit of this laudable ambition, Conrad *père* set out alone from Washington National Airport on Friday June 13th, on a "personal goodwill mission" to Scandinavia.

His aircraft—a Piper Pacer 135 (125 h.p. Lycoming with c.p. airscrew)—has thus become easily the smallest aircraft to have made (or, to our knowledge, attempted) a transatlantic flight. Mr. Conrad flew *via* Old Town, Maine; Goose Bay, Labrador; Bluie West, Greenland; Keflavik, Iceland; Stornoway, Hebrides; and Stavanger, Norway. A cruising level of 7,000ft was maintained whenever cloud or ice permitted. Unlike so many previous solo Atlantic pilots, Mr. Conrad appears to have been not only at ease, but physically comfortable.

His Pacer had an efficient heater and the good trim allowed him to spend much of his time keeping a log while flying hands-off. It was, apparently, quite simple to replace a defective radio-altimeter valve while airborne, while another part of Mr. Conrad's log reads "More icebergs below. Circled one to take movie film."

On the face of it, such an entry gives the impression that—provided one doesn't mind starting to fly at 3 a.m. each day—this solo transatlantic flying is all too easy. Perhaps Mr. Conrad's ten children will each confirm this.

*MAX CONRAD at Stavanger after his Atlantic flight (see above).*

# HERE AND THERE

*SURFACE TRANSPORT to the rest-house for the crew of an Aden Airways DC-3. Various aspects of this B.O.A.C. subsidiary's operations were illustrated in "Flight" last week.*

### Goodyear "N" Delivered

THE new 875,000 cu ft Class N airship was flown 400 miles last week from the Goodyear Aircraft Corporation's Akron, Ohio, works to the Lakehurst Naval Air Station. Of 324.5ft overall length and 73.5ft maximum diameter, the airship is, we believe, powered by two 800 h.p. Wright R-1300-2 radials mounted in an engine-room and driving 18ft Curtiss airscrews on outriggers.

### Luck—and Courage

A PILOT from the carrier *Princeton*, Lt. Clayton K. Alford, baled out when his Corsair was hit by A.A. fire over North Korea. Landing, burned about the hands and face, in a rice-field, he was surrounded by Communist troops, but held them back with a pistol, killing two; then, in the nick of time, he was picked up by a rescue helicopter—which, incidentally, saved another pilot, this time from the sea, on its way back to base.

### Lancs Fly Again

FOUR Lancasters, long stored at Aston Down, have been taken out of retirement, re-decorated with (we are assured) correct squadron markings and flown to R.A.F. Station Upwood, where they are being used in the making of a Mayflower Pictures film entitled *An Appointment in London*. Whereas *Angels One Five* (technical inaccuracies in which provoked much argument in *Flight*'s correspondence columns) dealt with R.A.F. fighter squadrons, this new film is a Bomber Command story. Dirk Bogarde, as a squadron commander—a contrast to his usual "spiv" parts—is one of the three stars.

### P.S. from America

FROM our American correspondent, since his column in this issue (page 766) went to press, comes an amendment to the list of companies granted helicopter-operation certificates. Changes have now been made in the names of those authorized to fly in the New York area and "New York Airways" should be substituted for "Metropolitan Air Commuting."

### Royal Routes

THE Ministry of Civil Aviation, in *Notice to Airmen* No. 353/52, issues details of temporary control areas, to be known as Purple Airways, which will be established at times when flights are being made by members of the Royal Family. Purple Airway One will be from London to Marham (for Sandringham) and Purple Airway Two from London to Aberdeen (for Balmoral). Both lanes are ten miles wide and extend from 3,000 to 11,000ft. Others may be announced.

### Coveted Award

BY the wish of Her Majesty the Queen Mother, the Queen's Cup—premier award at the Northern Heights Model Flying Club's Gala Day—is in future to be known as the Queen Elizabeth Cup. It will be presented, at Langley Airfield, next Sunday, June 29th, by the Lady Mayoress of London.

### Major de Havilland Hurt

WE were sorry to hear that Maj. Hereward de Havilland, joint managing director of de Havilland's Airspeed division at Christchurch, was injured when his car was in collision with a lorry at New Milton, Hampshire. He was taken to Lymington Hospital with a broken leg and shock, but was reported, last week-end, to be recovering satisfactorily.

### Public Appearance

THE Short S.A./4, which had only once previously appeared at a public display—the 1951 Farnborough Show—was among the aircraft which took part in the S.S.A.F.A. Display at Sydenham Airport, Belfast, on June 14th. Other machines demonstrated included such contrasting types as a Canberra and the Avro Anson WJ561, last product of the long "Annie" assembly-lines.

### Mr. W. C. Jackson

THOSE who knew him at Rochester and elsewhere will be grieved to learn of the death (which took place recently in Coventry) of Mr. W. C. Jackson, who was an assistant designer to Mr. (now Sir Arthur) Gouge in the days of the Empire flying-boats. Mr. Jackson, who was in charge of the Shetland project, left Short Brothers in 1946, and later joined the Dunlop aviation division.

### Success of an Exhibition

"THIS is a better exhibition, better organized and better displayed, than ours in the States or any exhibition I have seen"—the comment of an American executive, Mr. Harold I. Miller, on the recent Mechanical Handling Exhibition at Olympia. The show drew an attendance 40 per cent. higher than on the last occasion, in 1950.

*AIR MARSHAL J. D. I. HARDMAN, O.B.E., D.F.C., R.A.F., who received a knighthood (K.C.B.) in the Birthday Honours, is seen with senior officers of the Royal Australian Air Force (of which he is Chief of Air Staff) when they met to congratulate him. On the left is G/C. G. D. Candy, O.B.E.; Air Marshal Hardman is offering a cigarette; next is A.V-M. J. E. Hewitt, C.B.E., Air Member for Supply and Equipment; and accepting the cigarette is A.V-M. E. A. Daley, C.B.E., Director-General of Medical Services. Expressions suggest that the knighthood gesture was made at the behest of the photographer—a situation of the kind in which we have often sympathized with the victims.*

# GLOSTER G.A.5

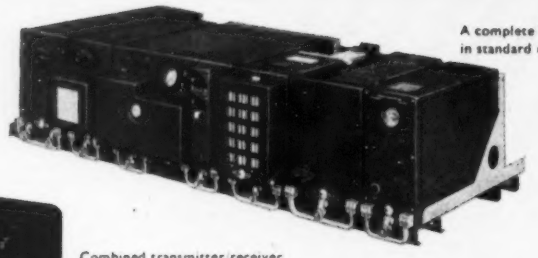
# SUPER PRIORITY

Combining the Delta planform's vital advantages of greater speed, longer range and bigger payload in a brilliant all-weather day and night fighter, the Gloster GA 5 has been officially ordered into super priority production for the R.A.F.

**GLOSTER AIRCRAFT CO. LTD., Hucclecote, Gloucestershire**

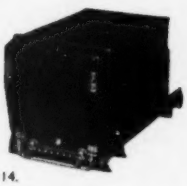
*Member of the Hawker Siddeley Group | Pioneer . . . and World Leader in Aviation*

C



A complete Type **AD.107B** transmitter, in standard racking.

Combined transmitter/receiver controller Type 1620.



Receiver Type AD.114.

A radio installation comprising **AD.107B/114** provides long distance pilot operated HF R/T for modern airline requirements.

- **120 watts R/T**
- **Frequency coverage 2—18.5 Mc/s**
- **20 crystal-controlled communication channels**
- **10 extra crystal-controlled receiving channels**
- **Pilot's controller operates both transmitter and receiver**
- **Unit construction with maximum accessibility**

# MARCONI air communications

MARCONI'S WIRELESS TELEGRAPH COMPANY LTD · CHELMSFORD · ESSEX

## HERE AND THERE . . .

### Another New U.S. Carrier?

THE Senate Military Services Committee is said to be considering whether to sanction the construction of a second 60,000-ton aircraft carrier similar to the U.S.S. *Forrestal*, now under construction.

### Relativity

RECENTLY a letter appeared in a Sunday paper from a private owner complaining that: "My car does 50 m.p.h., but my aeroplane will only do 60 m.p.h. (allowing for a 35 m.p.h. headwind)." Perhaps some more enthusiastic pilot will point out that *his* aeroplane will in fact fly at 130 m.p.h. (with a tailwind), but his car does only 10 m.p.h. (in London traffic).

### Not-so-empty Spaces

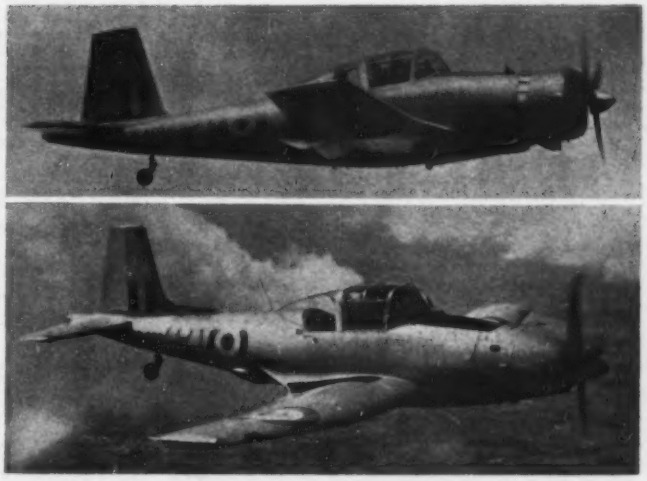
CANADA is to prospect 100,000 square miles of almost virgin territory in the Far North by air this year, continuing the search for new mineral resources. A team of geologists will use helicopters and other aircraft to cover the vast empty spaces lying west of Hudson Bay towards the Great Slave Lake. The uranium belt in the goldfields area of North Saskatchewan will receive special attention.

### Smoothing the Ride

ANTICIPATING the effect of bumpy air on fast airliners of the future, the Lockheed Aircraft Corporation has developed a "bump-manufacturer." This new item of test equipment imposes simulated flight loads with transient values of up to 2 g to a form of cushioning apparatus, the nature of which is unstated. When this cushioning equipment is fully developed it will, no doubt, become a feature of the forthcoming Lockheed turbojet transport.

### For the Wild Blue Yonder

AMERICA'S Department of Defence has lately revealed some interesting information on the selection and training of cadet pilots for the U.S.A.F. Cadets must be between the ages of 19 and 26½, fit and high-school-educated. They receive 48 weeks' training before being awarded "wings" and commissions as second lieutenants. During training they are paid some £37 10s monthly; each also qualifies for a £3,500 Government insurance policy which remains in effect as long as he is on active service. Training periods are: preflight training and light-plane screening, six weeks; primary training (on T-6s), 18 weeks; basic flying training, 24 weeks. During the last period, single-engine pilots fly T-33 Shooting Stars, and those chosen for multi-engined flying are trained on T-28s and B-25 Mitchells.



*STILL GOING STRONG: Originally engined, as seen in the upper picture, with a Bristol Mercury, VL892, the first prototype Balliol, or P.108, has for a considerable time been powered with a Mamba turboprop and in this form has served with Armstrong Siddeley as a development aircraft. After being brought up to date by Boulton Paul, as seen in the lower picture, it is now at Boscombe Down for trials. Later it will go to the Empire Test Pilots' School for instructional use.*

## IN BRIEF

COL. C. F. DE PORTO, Italian Air Attaché in London, recently visited the Sperry works. Accompanied by his assistant, Maj. G. Ciarucci, he was received by W/C. J. C. B. Bell.

*MR. P. J. ELLIS, O.B.E. in the recent Birthday Honours. Associated with R. B. Pullin and Co. Ltd., the instrument manufacturers, since their foundation, he succeeded Mr. R. B. Pullin as managing director five years ago.*

Dart Aircraft, Ltd., are now at their new address at Market Place, Chalfont St. Peter, Bucks (Gerrards Cross 3881), where enlarged design, manufacturing and repair facilities are available. A branch is to be opened at Denham, the nearest airfield.

* * *

A revised catalogue of "Thessco" silver solders, brazing alloys and fluxes has been issued by the Sheffield Smelting Co., Ltd., Royds Mill Street, Sheffield 4.

* * *

Motor Generator Corporation, Troy, Ohio, U.S.A., send a folder outlining methods of gas-turbine starting and aircraft servicing with ground power-supply units.

* * *

Mr. C. C. Stewart, formerly manager of the technical service department of Cellon, Ltd., has been appointed northern area manager in succession to the late Mr. F. Farquhar. His office is at 16-20 Great Ancoats St., Manchester 4 (Central 4771).

* * *

Aerocontacts, Ltd., of Gatwick Airport, Surrey, have organized a servicing and sales unit which, with a licensed engineer in charge, will attend the major air races and rallies in this country and in France. It made its first appearance at the recent R.Ae.S. Garden Party.

*BY LAND AND SEA: On the left is a Sabre F-86F (General Electric J47-GE-27) as now in production at North American's Los Angeles and Columbus plants. This is the most recent of the U.S.A.F. Sabre series, and for comparison, on the right, is shown a U.S. Navy XFJ-2 Fury (a carrier-borne Sabre development). Note the long-travel oleo legs, extra-long drop-tanks, and absence of guns. An all-rocket armament may be intended.*

# Our American Correspondent Reports . . .

SOME of the biggest jumps in aviation technical development have been made under the pressure of war. Korea is proving no exception; but, because of the nature of the ground fighting there, it is the helicopter that is reaping a lot of the benefit this time. There are today eight major American companies engaged in the development of rotating-wing aircraft—plus a number of smaller firms who have not yet made the big league but who may do so at any moment.

One of the most interesting of these latter is the Gyrodyne Company of America, who are now flying their Model 2C. This is a 5,400 lb aircraft with two co-axially mounted twin-blade rotors, powered by a Pratt and Whitney Wasp Junior. The aircraft is designed to carry a pilot and six passengers, and the company is hoping for C.A.A. certification this summer.

The Big Eight have between them some 25 to 30 specifications, ranging from the Piasecki XH-16, a 42-seater with two Pratt and Whitney 1,650 h.p. engines down to the single-seater ramjet McDonnell XH-20. They have others, of course, but the veil of secrecy hangs heavily over the industry, and the list of types below, drawn up by the Helicopter Council of America, is all that can be published at the moment.

| Maker's Type | Seats | Engine(s) | h.p. | USAF | USA | USCG | USMC | USN |
|---|---|---|---|---|---|---|---|---|
| BELL :— | | | | | | | | |
| 47 | 2 | Franklin | 178 | YH-13 | YH-13 | HTL-1 | HTL-1 | HTL-1 |
| 47 B | 2 | Franklin | 178 | H-13B | H-13B | HTL-2 | HTL-2 | HTL-2 |
| 47 D | 2 | Franklin | 200 | H-13C | H-13C | HTL-3 | HTL-3 | HTL-3 |
| 47 D-1 | 3 | Franklin | 200 | H-13D | H-13D | HTL-4 | HTL-4 | HTL-4 |
| 47 D-1 | 3 | Franklin | 200 | H-13E | H-13E | HTL-5 | HTL-5 | HTL-5 |
| 48 | 10 | P. and W. | 600 | YH-12 | — | — | — | — |
| 61 | 3 | P. and W. | 1,900 | — | — | — | — | XHSL |
| DOMAN :— | | | | | | | | |
| LZ-4 | 8 | Lycoming | 400 | — | — | — | — | — |
| LZ-5 | 2-6 | Lycoming | 400 | — | — | — | — | — |
| HILLER :— | | | | | | | | |
| UH12 | 3 | Franklin | 178 | — | H-23A | — | — | HTE-1 |
| UH12A | 3 | Franklin | 200 | — | H-23B | — | — | HTE-2 |
| HUGHES :— | | | | | | | | |
| (Restricted) | — | — | — | XH-17 | — | — | — | — |
| KAMAN :— | | | | | | | | |
| K-240 | 3 | Lycoming | 245 | — | — | — | HTK-1 | HTK-1 |
| K-3 | 4 | Continental | 525 | — | — | — | HOK-1 | HOK-1 |
| McDONNELL :— | | | | | | | | |
| 38 | 1 | McDonnell ramjet | — | XH-20 | — | — | — | — |
| 79 | 1-2 | McDonnell ramjet | — | — | — | — | — | — |
| PIASECKI :— | | | | | | | | |
| — | 10 | P. and W. | 600 | — | — | HRP-1 | HRP-1 | HRP-1 |
| — | 10 | P. and W. | 600 | — | — | — | HRP-2 | HRP-2 |
| — | 6 | Continental | 525 | — | — | — | — | HUP-1 |
| — | 6 | Continental | 560 | — | — | — | — | HUP-2 |
| — | 6 | Continental | 560 | — | H-25A | — | — | — |
| — | 16 | Wright | 1,150 | YH-21 | — | — | — | — |
| — | 16 | Wright | 1,150 | H-21A | — | — | — | — |
| — | 22 | Wright | 1,425 | H-21B | H-21B | — | — | — |
| — | 42 | 2 P. and W. | 1,650* | XH-16 | — | — | — | — |
| SIKORSKY :— | | | | | | | | |
| S-51 | 4 | P. and W. | 450 | H-5 | — | HO3S | HO3S | HO3S |
| S-52-2 | 3-4 | Franklin | 245 | — | YH-18 | HO5S | HO5S | — |
| S-55 | 10-12 | P. and W. | 600 | H-19 | H-19 | HO4S | HRS | HO4S |
| S-56 (restricted) | — | — | — | — | — | — | HR2S | — |

*Each engine

As will be seen, the Hughes twin-rotor XH-17 [illustrated on page 707 of *Flight* for June 13th—ED.] is the most strictly "classified" machine, i.e., information about it is severely restricted. It is powered by two General Electric turbojets and is known to be a big and powerful aircraft. It was severely damaged during its initial tie-down tests, but is working again now. As for the types that are in use for civil work, the Bell 47, and Sikorsky S.51 and S.52 lead the field. A considerable amount of flying is being done with these machines all over the States in the way of police patrol, survey work, pipeline inspection, crop-spraying and the like. Two commercial operators have actual mail routes. Los Angeles Airways were the first to start, with a mail service around that area, and it has been sufficiently successful for them to be able to get a limited passenger-certificate. They now have two passenger Sikorsky S.55s on order. A company with similar aims, Helicopter Air Service of Chicago, have six Bell aircraft and operate mail routes between the main post-office in that city and the airport and outlying districts. In New York another new company, Metropolitan Air Commuting, have just been granted a C.A.A. certificate, but have not yet started any operations. In New England, Wiggins Airways (who at one time favoured the de Havilland Dove) are toying with the idea of a helicopter passenger service throughout the North-Eastern States.

* * *

THE Civil Aeronautics Administration look with qualified favour on all this activity, but wisely feel that, until there is a reliable twin-engined helicopter available, it is not safe to carry passengers over crowded cities or built-up areas. In fact, even for the all-mail services they are quite strict in controlling the routes so that they are over open or semi-open country. There is always the final hop to the Post Office, of course; but even this has to be flown along a route where engine failure would give a good chance of a forced landing without danger to those on the ground. Apart from such precautions, the C.A.A. have been doing their best to keep services as free from red tape as possible, working out the operational and safety requirements as they went along.

Once the manufacturers here are free of military commitments, civil helicopter operations will make great strides. In the long-term view there is full agreement with those in England who believe that for journeys up to 200 miles or so the helicopter is the answer—particularly if noise and danger problems tend to force the big airports away from city centres and out into the country. Moreover, a survey has shown that more than 90 per cent of all railroad, bus and car traffic is for 100 miles or less, and this traffic could well be handled by helicopter routes.

* * *

INCIDENTALLY, the rotating-wing boys here seem to have been just as guilty as their fixed-wing confreres in luring away British technicians. One keeps on hearing of well-known helicopter engineers who have just, or are just about to, join American companies. At a time when the needs of Britain are so urgent, and when she is engaged in a struggle with her friends for civil air supremacy, this is sad news. One only hopes that the material values here, which from a distance must appear so alluring, will live up to their advertised claims and not, on closer inspection, lack lustre. These things aren't always what they seem. The ice box and the washing machine and full-to-bursting grocery store may help to create creature comforts, but they can be poor substitutes for older and more valuable heritages. Furthermore, if there is a recession in the United States—and this may well happen if there is a let-up in the rearmament programme—the laws of economic survival will deal harshly with late-comers.

* * *

HARD on the heels of the U.S. Air Force publicity about their new global bombers, the B-60 and B-52, comes news of a report known as Project Vista. Mr. Hanson Baldwin, military correspondent of the *New York Times*, writes as follows :—

"A major effort to increase the nation's tactical air strength and fundamental revisions in the Air Force system of supporting ground troops are urged in the final report of Project Vista, now under study in Washington.

"Project Vista, an operational analysis of the application of fire power to the ground battlefield, was made for the armed services by the California Institute of Technology, and represents one of the most thorough scientific approaches to the problem yet made.

"According to one informant, it scores what it terms the 'imbalance' in United States military strength today as due to past adherence to the one-weapon strategic concept—the atomic bomb carried by long-range bombers—and it advocates the maximum possible development of tactical atomic weapons. The

tactical use of atomic weapons would be directed against ground troops, airfields and military supply lines.

"Decentralization of, and major modifications in, the Air Force system used for the control of aircraft providing close support for ground troops is reported to be urged in the Vista survey. . . ."

"The Vista survey also urged, officers said, extensive use of aircraft carriers as bases for atomic attack. But while stressing the importance of the most rapid possible development of atomic weapons for tactical purposes, Project Vista specifically denies that atomic and other new weapons can, as yet, replace so-called conventional arms."

". . . Its conclusions are interpreted by the Army, by the Navy and by some in the Air Force as a definite blow to the 'big bomber' school of thinking that dominated the Air Force and our strategic concepts for some time after World War II.

"The report's defenders, while endorsing many of the general conclusions, admit that the report is somewhat diffuse and segments of it are deeply steeped in theory. The big-bomber school, moreover, believes that its own theory of defence will be justified within the course of a few months by the test at Eniwetok atoll, our mid-Pacific atomic proving ground, of the world's first prototype of a hydrogen or thermo-nuclear device. The test device scheduled to be detonated at Eniwetok in the fall cannot be termed a trial of the 'hydrogen bomb,' for the detonation of the device, though dwarfing by far all other nuclear explosions in history if it works, will probably be of considerably less power than the ultimate hydrogen bomb. . . ."

By the time this column appears in print, there will probably be further repercussions to this report. It may well create a minor upheaval. In an election year Congress always seizes on anything which could be made an issue, and this is useful ammunition in connection with the Armed Services and allocation of aviation funds. The big-bomber programme might even be in danger.

In the past, and as long as the American public was allowed to believe what it wanted to believe—that American control of the atomic bomb was the answer to everything—the supporters of strategic bombing had it all their own way. This belief in the bomb was so deeply rooted through all sections of society that it played a major part in American thinking and policy for several years after the war. Only when it was announced by the President himself that the Russians also had atomic weapons were people jolted into the realisation that they had been putting their faith in a false god and that they too were open to such an attack. This was a severe shock.

Whether Project Vista will help or hinder confusion remains to be seen.

* * *

TO conclude on a more pacific note, there has been considerable mention in both the technical and lay Press here about Lindbergh's non-stop solo flight to Paris 25 years ago. Almost all the papers gave him the credit for opening up the Atlantic transport era—and one or two practically suggested this was the first non-stop crossing. Of the magazines read by this correspondent, not one mentioned Alcock and Brown. It is perhaps natural for the American public to have the idea that Lindbergh's magnificent flight was indeed the first non-stop one, but papers such as *Life* and *American Aviation* should have had the knowledge (and courtesy) to include the Vickers Vimy crossing when they reviewed the Atlantic picture—if only for the sake of historical accuracy. Although the flight did not originate in the States, and although it was an all-British affair it was, after all, the real forerunner of the transatlantic services. The aircraft had two engines, a pilot and navigator, and did land in Ireland. Also, the occupants finished their journey by surface transport—for technical reasons! What more proof do you want?

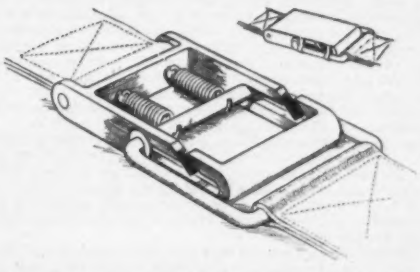
# A SELF-RELEASING SEAT-BELT

BELIEVING that, if aircraft accidents cannot be entirely prevented, then the next best thing is to minimize their consequences, Mr. J. R. Sturge Whiting (of 7a West Street, Reading, Berks) has devoted considerable time to the invention of passenger-safety devices. In *Flight* of February 8th, 1951, we described a scheme of his for anchorage of seats to steel cables concealed under cabin-floor carpeting (to prevent break-away and piling-up of seats) and certain airline operators have shown considerable interest in the idea.

Now he comes forward with another device (also subject of a patent application), this time for a seat belt which is automatically releasable under an excess g-load, thus relieving a badly shaken passenger of the necessity for thinking how to unfasten his belt, or, at the worst, of enabling rescuers to free him quickly. Needless to say, the inventor has the fire risk in mind.

The perspective drawing indicates the general principle of the device, which is intended either for incorporation in an extension of the orthodox manual quick-release buckle or for separate insertion at any point in the belt.

It will be seen that one element of the coupling consists of a flat box, in the slotted sides of which the other element, a simple bridle, is free to slide; the bridle is normally restrained against one end of the slots by two coil springs, the tension of which can be pre-set by suitable means at their anchorages. Near the other end of the slots are escape channels leading upwards and outwards, the way to which is, however, barred by spring-steel check strips. It should be noted that the tension springs hold the bridle by half-hooks, which would allow it to fall free if tension were relaxed.



*General arrangement of the automatic-release device. This sketch does not purport to show exact mechanical details, the design of which would depend on production considerations. The inset illustrates how a neat cover plate, perhaps chromium plated, might be added to the release element.*

In use, the springs are so adjusted that under any ordinary loads the bridle is held back in the slots, and out of contact with the check strips. In the event of a crash, however, and a consequent excess g-load, the bridle will be pulled forward, will overcome the resistance of the check strips, and will so pass them. As tension decreases after the initial shock, the coil springs re-assert themselves and cause the bridle to ride up the outsides of the check-strips and so out *via* the escape slots. The moment tension is completely relaxed the coil-spring hooks will fall away, thus leaving the bridle quite unattached to the other member.

The inventor emphasizes that the device does not merely limit the belt-loading to a pre-determined maximum, but would hold any load up to the full capacity of the belt-strength.

Mr. Sturge Whiting has also approached the problem by an alternative method in which the basic principle is similar, but the method of application quite different. In this case a small cylinder is pivoted at its lower end to the point at which one end of the belt is normally attached to the seat frame. Within the cylinder is a piston, the piston-rod of which leads upwards through an end-cap closing the upper end of the cylinder. The top of this rod is rigidly attached to a yoke which carries the end of the belt. The piston is loaded in a downward direction by a fairly strong coil spring between piston and upper end-cap.

These are the main components; the operative principle lies in the method of attachment of the piston-rod to the piston: the rod passes freely through the piston, but is retained underneath by split cotters exactly as in an I.C. engine valve, the cotters being held in their recess by the pressure of the spring.

About half way up the cylinder, and diametrically opposite one another, are two spring pawls which project a short distance into the cylinder bore. Should an excess load be placed on the belt, the piston is pulled upwards beyond the pawls, which then spring back into the check position, thus preventing the return of the piston down the bore. The rod, however, is free to move downwards through the piston the moment the excess load is relaxed, and when this happens the split cotters fall out and the rod is free to pull completely out of the piston and cylinder, thus releasing the belt from its anchorage. The inventor acknowledges that in certain exceptional circumstances the load on the piston rod might not fall to zero after the initial impact, but he provides for incorporation of a simple ejection-device to assist the separation of the cotters before the load is completely relaxed.

For both systems Mr. Sturge Whiting has a number of detail refinements in mind.

# TITANIUM

## *Far-reaching Potentialities of a "New" Metal in Airframe and Gas-turbine Construction*

**A SHINING metallic element, newly introduced in its own right as an engineering material of rapidly increasing importance, may be heralded as a panacea to cure many design problems—particularly when it has so euphonious a name as titanium. That titanium has certain qualities that are undesirable will be apparent from this survey of the characteristics and aircraft applications of the metal; but in spite of these disadvantages the new element is assured of a very important place in industry—and particularly in the aircraft industry. The study which follows is based upon information from authoritative sources, including technical notes by I.C.I. Metals Division, who are among those pioneering work on titanium alloys in this country.**

FOR the first 150 years after its discovery in 1791 (by the English clergyman William Gregor) the element titanium was employed only in very small quantities, as an alloying metal and—as the oxide—in the paint industry. It is the fourth most abundant constructional metal—only aluminium, iron and magnesium being more widely distributed—yet it has so high an affinity for other elements, particularly oxygen, that it is nowhere found in its metallic state.

As a result, although titanium-bearing ore is mined to the extent of 500,000 tons per annum at a cost of a few pence per pound, the extraction of the metal is at present a difficult and costly process, and British production is measured in pounds.

Nearly all the metal at present produced is extracted by a process developed by William Kroll, an engineer of the U.S. Bureau of Mines, in 1946. Rutile, the abundant titanium oxide $TiO_2$, is mined, washed, and chlorinated to provide the chloride $TiCl_4$. This chloride is then reduced with magnesium at about 1,562 deg F, and the titanium metal obtained by leaching with cold hydrochloric acid or by vacuum distillation. The metal so obtained is in a powdery, or spongy, form with a purity of about 99.5 per cent.

Titanium about 99.9 per cent pure can be obtained by decomposing titanium iodides on the surface of a hot wire—the Van Arkel process—but, as may be imagined, this method could never practicably be used for large-scale production.

Various methods are in use for converting the spongy metal into ingots. Sintering and vacuum forging have been employed, but present attention is largely focused on methods which melt the metal.

Serious difficulties continue at this stage, for molten titanium dissolves, or is contaminated by, most substances, including all known refractories. One of the most frequently used methods involves the arc-melting of the "sponge" in a water-cooled copper crucible, using carbon or tungsten electrodes under an inert atmosphere such as argon.

Like nearly all metals, titanium exhibits radically changed properties when contaminated with other elements. These effects are far too complex to enumerate, but some general observations may usefully be given. Gases combine readily with hot titanium to give an increase in strength at the expense of reduced ductility; nitrogen is especially potent in its effect. Carbon produces similar results and 0.25 per cent is about the maximum concentration that can be permitted.

Titanium is a silvery-white metal with a density of 4.507 gm/cc (0.163 lb/cu in). It has a melting point as high as 3,125 deg F, but thermal conductivity is low at 0.0225 calories/cc/deg F/sec. The metal thus falls neatly between the light alloys and the steels, and has a better strength/weight ratio than either.

The mechanical properties of titanium itself, and of certain selected alloys, are set out in the table on page 770; further characteristics of two alloys are given in Figs. 3 and 4. It is not proposed to list the effects produced by the addition of alloying elements, as Fig. 1 provides an overall picture of the properties of binary alloys.

### Fabrication Characteristics

Titanium alloys generally have but a moderate hardness (see table of properties) and can be manipulated by existing machine tools without trouble if suitable methods are closely followed. Nevertheless, unusual characteristics are exhibited by these alloys and much experimental work clearly remains before workshop

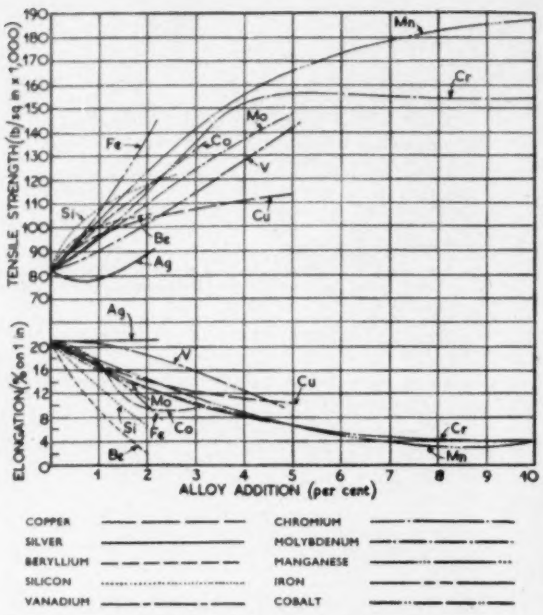



*Fig. 1. The effect of alloying additions upon the tensile properties of binary titanium alloys.*

processes can be considered satisfactory; this is particularly true of grinding operations.

Perhaps the most annoying characteristic of the metal is its tendency to gall, i.e. to adhere to other metallic surfaces; this is sufficient to render titanium alloys generally unsuitable for use where sliding friction is encountered. A second cause of trouble can be the severe abrasive action of included particles of titanium carbide, introduced by the use of carbon electrodes in the ingot preparation.

*Forging.*—Although titanium-alloy blading for gas-turbine compressors has been successfully upset at 1,950 deg F (and smoothed by hammer forging at 1,700 deg F) temperatures should not, if possible, be permitted to rise much above 1,600 deg F if gas absorption, and consequent embrittlement, is to be excluded. This is especially applicable to light sections and sheet. On the other hand, selection of a lower temperature than 1,600 deg F is very prone to lead to cold-work cracking.

A workable sequence for Ti 150A (Fig. 3) is: soak at 1,200 deg F, heat to 1,600 deg F, and then use heavy equipment to forge when the temperature has dropped to 1,300 deg F. After forging it is recommended that Ti-Cr-Fe alloys be annealed at about 1,250 deg F and air cooled.

*Swaging.*—This process has been carried out at below 500 deg F, although a preferable temperature appears to be about 1,600 deg F. At the higher temperature the oxide film is strong enough to nullify the seizing tendency of the metal.

*Extrusion.*—At present, titanium can be extruded only with considerable difficulty; seizing and die-wear are liable to be troublesome and high pressures are required. Much experimental work is, however, now being carried out on extrusion problems.

*Turning and milling.*—In these operations titanium approximates to stainless steel. Titanium-carbide particles can cause rapid tool wear, particularly when the smearing tendency of the work causes build-up and friction-grinding of the cutting edge. As soon as the tool becomes blunted, the work surface becomes work-hardened and machining becomes virtually impossible.

Straight tungsten-carbide tools can be used for roughing, taking a cut $\frac{1}{4}$in deep with a 0.015in feed at 60ft/min; straight carbide tools are preferable for finishing, the depth of cut then being reduced to about $\frac{1}{16}$in with a feed of 0.020in at up to 185ft/min. These figures assume the use of normal soluble cutting-oil, fed generously to cool the tool and to prevent the spread of (possibly explosive) titanium dust.

Until recently, this was the only effective method of machining titanium alloys; nevertheless, there were drawbacks in that not only was the tool set-up inclined to be critical, but the expensive swarf was non-recoverable, the introduction of impurities from the oil prohibiting re-melting. New techniques have now been perfected, using carbon dioxide as the coolant. The $CO_2$ is supplied as a liquid, under about 850 lb/sq in pressure, through 0.010in jets directed at the tool cutting-edge.

The overall effect of this technique is very complex and lengthy to describe, but it can be said that in the U.S.A. it has revolutionized the whole picture of machining all hard alloys. In the case of titanium, the hardest alloys can be cut, through the scale, at over 300ft/min to a depth of $\frac{1}{8}$in with a 0.015in feed. Again, the swarf is non-oxidized and free from any contamination; thus, complete recovery can be effected. Many further advantages in the fields of temperature-control, cleanliness, tool-life and tool-sharpening also accrue from $CO_2$ cooling. It is worth stressing that this technique can ensure that all parts of the cutting zone are maintained at room temperature—by varying the coolant flow and direction—so eliminating burnishing, stabilizing dimensions and metallic micro-structure and greatly prolonging tool-life (one U.S. titanium-machining plant has reported an extension in tool life of 450 per cent).

*Sawing.*—Using $CO_2$, speeds of 400ft/min are typical, but with cutting oils this value should be set at some 150ft/min, using a high-speed steel blade of about ten teeth per inch.

*Drilling and tapping.*—Again, this type of work is hampered by the tendency of the metal to work-harden and chip-weld, and by the tough non-curling swarf and poor thermal conductivity. Work-hardening is minimized by drilling continuously, without pilot holes, and by using high-cobalt drills. Off-centre points have been experimented with, in order to form an eccentric hole only touched by the drill along one side at any time, notched lips being used to break the swarf.

Carbon-dioxide appears to be the best coolant and a good included point-angle is 135 deg. This arrangment can be used to drill a 17/64ths in hole at 450 r.p.m. (31ft/min) at 0.006in/rev; up to 90in should be possible between re-grinds. Reaming can be carried out with straight- or spiral-flute tools at normal speeds; a taper reamer, or one with excessive lead-angle, is preferable if chatter is to be avoided. Tapping at 12 to 15ft/min can be performed on 60 per cent thread using interrupted-tooth taps.

*Grinding.*—Probably the most difficult operation of all, grinding is at present considered "good" if wheel-wear is less than *one-third* of the metal-removal rate. Aluminium-oxide wheels of about size-60 grit are suitable, grinding being carried out wet at low speed—say, 2,500ft/min.

*Press-forming.*—Most shapes capable of deep-drawing in low-carbon mild steel can be repeated in titanium; but press speeds need to be lower and pressures higher. The vexed cold-welding question appears to be beaten by a new lubricant which is now under development for application to the die surface; it is hoped to make this solution adherent up to 600 deg F.

*Welding and brazing.*—If gas-absorption is avoided, good titanium-titanium joints present little difficulty. Argon-arc and Heli-arc equipment typically produces welds with parent-metal strength, albeit with slightly reduced ductility. Spot and seam resistance welding is an everyday operation in many American factories, and the metal-surface condition appears to have little bearing on the result. Very good results have been obtained from flash-butt welding high-strength alloys, although not from similar welds in unalloyed titanium.

Cooling from welding temperature still results in some "quench-hardening," but hot-rolling can be employed to improve post-weld ductility. The best brazing appears to result from silver or aluminium alloy spelter using fluoride fluxes.

*Tube-drawing.*—By the end of this year seamless tubing should be in production by normal methods. At present, only short lengths of seamless tube can be made, welded-and-drawn tubing being more common. This is available up to about 2in o.d., and can be bent and flared nearly as well as can similar stock in stainless steel.

*Riveting.*—Unalloyed titanium wire has been successfully cold-headed down to $\frac{1}{4}$in shank diameter, a flash-coating of copper sometimes being used to overcome the galling tendency. Riveting appears to be preferable in the hot state; a phosphate coating is necessary where the metal is to be attached to aluminium or cadmium.

*Annealing.*—Most titanium alloys require heating to about 1,300 deg F for 30-50 minutes per inch of thickness. Unless thin sections are involved, an inert atmosphere is unnecessary. Light blasting and pickling should suffice to remove any scale formed.

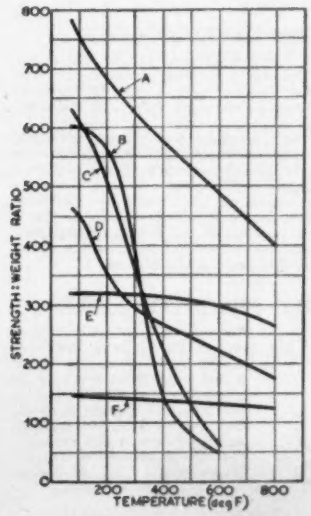
## Titanium for Aircraft Structures

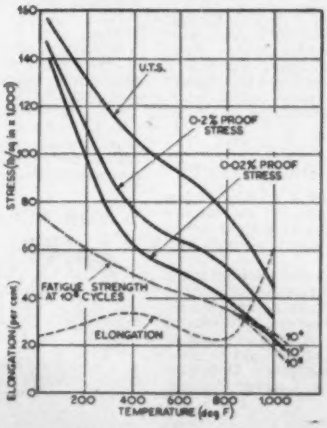
Kinetic heating is becoming of increasing importance as a problem to be faced in the structural design of fast aircraft. The indications are that titanium alloys will be of great benefit for such structures, since they maintain excellent mechanical properties up to the level of 500 deg F—although it may be stated that the strength-temperature properties of such alloys do not yet appear to be uniformly consistent. This may be due to the very limited quantity of metal which has so far become available for experiment, coupled with the present variation between test-pieces.

Nevertheless, supersonic aircraft—and missiles—appear to call for a structure almost totally of titanium. At present, if temperature-demands eliminate the use of light alloys, the designer has no choice but to use steel—with consequent weight penalties. It is quite conceivable that, were sufficient material forthcoming, the ideal wing for the fastest aircraft would be of solid titanium alloy.

It also appears that, provided titanium production is sufficient, nearly all the steel currently used in airframes can be replaced by titanium alloy. These new alloys have excellent corrosion-resistance—comparable with that of platinum—and can thus replace stainless steel in a number of applications where non-corrodibility is required. Similar changes to titanium may be made where high-tensile steel is now used purely from the point of view of strength; many titanium alloys can approximate to H.T. steel strength up to about 900 deg F.

The most inviting aircraft applications of the material appear to be in the gas turbine power unit. Up to rather over 900 deg F no other range of alloys can offer so good a strength/weight ratio;



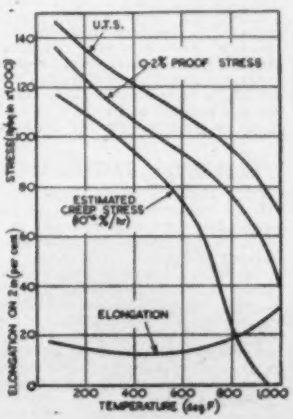




*Fig. 2.* (*Left*) *Strength/weight ratio against temperature for:* (*A*) *titanium alloy RC1308 (4% Al, 4% Mn);* (*B*) *aluminium alloy 14ST6;* (*C*) *magnesium alloy AZ80X;* (*D*) *commercially pure titanium RC70;* (*E*) *a hardened and tempered stainless steel, type 410;* (*F*) *type 347 stainless steel. (American alloy designations. Ordinate units in inches (lb/sq in divided by lb/cu in).*

*Fig. 3.* (*Centre*) *Mechanical properties of titanium alloy Ti-150A (2.7% Cr, 1.3% Fe, 0.25% O, 0.02% C, 0.02% N, balance Ti).*

*Fig. 4.* (*Right*) *Mechanical properties of titanium alloy RC1308 (4% Mn, 4% Al).*

## TITANIUM . . .

at the same time, it must be recognized that the titanium alloys deteriorate rapidly as temperature rises beyond 1,000 deg F, and this figure would seem to be the maximum temperature at which the alloys can be expected efficiently to operate. Present axial compressors rarely reach 500 deg F and it is unlikely that future pressure-ratios will cause a temperature-rise greater than 900 deg F; these alloys are therefore eminently suitable for all parts of the compressor. This is also an application where the good corrosion-resistance of titanium can be utilized.

Titanium alloys should also be capable of replacing the normal light alloys in compressor casings and aluminium bronzes in stator blading. Even the stainless-steel sheet now used for tailpipes and afterburners may advantageously be replaced by suitable titanium alloy where the operating temperature does not rise greatly above 900 deg F.

The fatigue performance of the alloys appears to be of a satisfactory order, although, understandably, categorical statements on this subject cannot be given with much authority. Some combinations appear to be rather notch-sensitive, although this may not be a characteristic of all. Unusually, shot-peening appears to result in decreased fatigue-resistance.

The lower modulus of elasticity of titanium alloys as compared with corresponding steels may result in the necessity of accommodating increased deflections. In a gas turbine, for example, some latitude may have to be permitted in the overall rigidity of the compressor and casing; use of the lighter alloy will, of course, permit heavier sections, or reinforcing flanges, to be used in restoring the stiffness of a steel structure. On the other hand, the lower modulus of elasticity should equally result in lower fatigue stress.

For compressor blading, high surface-finish is implied, thus to some extent obviating the apparently high notch-sensitivity of titanium alloys. It would appear that a large turbojet could, by the judicious use of these materials, be made at least 200 lb lighter than at present, with better resistance to abrasion and corrosion.

In rocket motors, higher temperatures are usually encountered than in turbines, although with generally reduced operating stresses. If, by suitable coolant—or fuel—flow, temperatures can be kept below about 900 deg F, titanium alloys should be preferable for most of the structure both of the rocket motor and its carrying vehicle. The thermal conductivity of titanium is, however, lower than that of steel and only one-eighth that of most light alloys; this may be a disadvantage in such installations. Rocket fuels, often corrosive, might be most conveniently piped and stored in titanium structures.

It should be noted that, at elevated temperatures (over 900 deg F), the deterioration in the mechanical properties of titanium alloys is largely brought about by the irreversible absorption of embrittling gases—chiefly oxygen and nitrogen. There are indications that recent experiments with ceramic-coated titanium will be very profitable; the porcelain coating is intended, in this instance, as a gas-insulator rather than as a thermal insulator.

The aforementioned galling tendency appears likely to exclude titanium alloys from the manufacture of gearwheels and many reciprocating engine parts. But the list of applications in which the new alloys look promising is impressive, including as it does high-pressure hydraulic piping; armour plate; instrument springs and diaphragms; large forgings—undercarriage units, for example; guns; airscrew blades; and—owing to the non-magnetic property of the material—installations near compasses.

Among present applications of titanium alloys may be mentioned the exhaust collector rings for Piasecki helicopters; compressor rotors and sundry other parts of Westinghouse and Wright turbojets (particularly the J-34, J-40 and J-65 Sapphire); the nacelles and undercarriage doors of the DC-7; and certain Solar afterburners.

Present cost and availability, it is believed, are not likely to remain unchanged for more than, perhaps, two years. At present the difficulty of extracting the element implies large capital expenditure if commercial production is contemplated. While this has been attempted in America—the Henderson, Nevada, plant of Titanium Metals Corporation, having a designed capacity of 3,600 tons per year—the United Kingdom is not undertaking large-scale titanium production until easier methods of extraction have been perfected.

At the present time, the "sponge" metal costs some 35s per pound, while forgings and bar stock approximate to £2 per pound, and sheet to £6 per pound—paid in dollars in each case. British production is largely centred on the I.C.I. pilot plant with an output of up to 100 lb of "sponge" daily. There is no doubt that, were improved extraction methods developed, not only would the material become "commercially" available in this country, but the price would be very greatly reduced. It is questionable, however, whether the supply would, for many years, be sufficient to meet the demand of the aircraft industry alone. W. T. G.

**MECHANICAL PROPERTIES OF SOME TITANIUM ALLOYS**

| Alloying Elements (per cent) | Treatment | U.T.S. (lb/sqin) | Elong (1 in %) | V.H.N. | Min. R. (in) |
|---|---|---|---|---|---|
| 0.04 C, 0.031 N, 0.24 W (unalloyed) | Hot-rolled | 81,400 | 20.8 | 187 | 1/8 |
| do. (unalloyed) | Heat-treated at 1,600 deg F | 74,100 | 19.3 | 172 | 1/8 |
| 2.2 Fe, 0.05 C, 0.05 N, 0.47 W | Hot-rolled | 146,500 | 8.5 | 305 | 1/8 |
| do. | Heat-treated at 1,600 deg F | 146,500 | 2.5 | 468 | 1/4+ |
| 7.5 Mn, 0.25 C ... ... | Hot-rolled | 221,400 | 2.0 | 438 | 1/4+ |
| do. | Heat-treated at 1,600 deg F | 164,700 | 0.5 | 287 | 1/4+ |
| 1.1 Fe, 0.15 C, 0.03 N, 0.17 W | Hot-rolled | 120,300 | 17.5 | 243 | 1/8 |
| do. | Heat-treated at 1,600 deg F | 130,500 | 10.0 | 426 | 1/4+ |
| 5.0 Cr, 2.0 Fe, 0.25 C ... | Hot-rolled | 198,000 | 4.0 | 401 | 1/4+ |
| do. | Heat-treated at 1,650 deg F | 160,300 | 1.0 | 455 | 1/4+ |
| 8.0 Cr, 1.0 V, 0.20 N ... | Hot-rolled | 207,800 | 3.5 | 390 | 1/4+ |
| do. | Heat-treated at 1,650 deg F | 85,700 | 0.0 | 536 | 1/4+ |

## TILTMAN LANGLEY APPOINTMENT

IT is announced that Mr. A. Kenneth Clyde, A.R.T.C., A.M.I.E.E., A.F.R.Ae.S., has been appointed assistant chief engineer of Tiltman Langley Laboratories, Ltd., of Redhill, Surrey. Mr. Clyde was from 1936 to 1938 a research engineer with C.A.V.-Bosch at Acton, and then joined the R.A.E., Farnborough, where he worked on aircraft electrical systems. From 1940 to 1945 he was in charge of an M.A.P. branch dealing with aircraft electrical installations, and in 1945 he joined the Ministry of Supply Instrument Research and Development Section, where he was responsible for the design and development of aircraft electrical power supplies and utilization.

## SCIENTIFIC-INSTRUMENT COMPETITION

THE Physical Society arranges each year a design, drawing and craftsmanship competition for apprentices and learners engaged in work connected with the design or manufacture of scientific instruments, and regulations for this year's contest have recently been issued.

Intended originally for employees of firms who exhibited in the Society's annual Exhibition of Scientific Instruments and Apparatus, the competition has now been opened also to employees in the workshops or drawing offices of educational establishments, to students attending recognized workshop or machine-drawing courses at technical colleges or technical schools, and to select bodies invited by the Council of the Physical Society. Details are obtainable from the Society's offices at 1, Lowther Gardens, London, S.W.17.

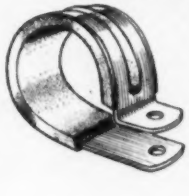
## WILLIAMSON DEVELOPMENTS

FORMERLY assistant managing director of the Williamson Manufacturing Co., Ltd., Mr. J. E. Odle, F.R.G.S., has been appointed joint managing director. Mr. C. M. Williamson, C.B.E., F.R.P.S., continues as chairman and joint managing director.

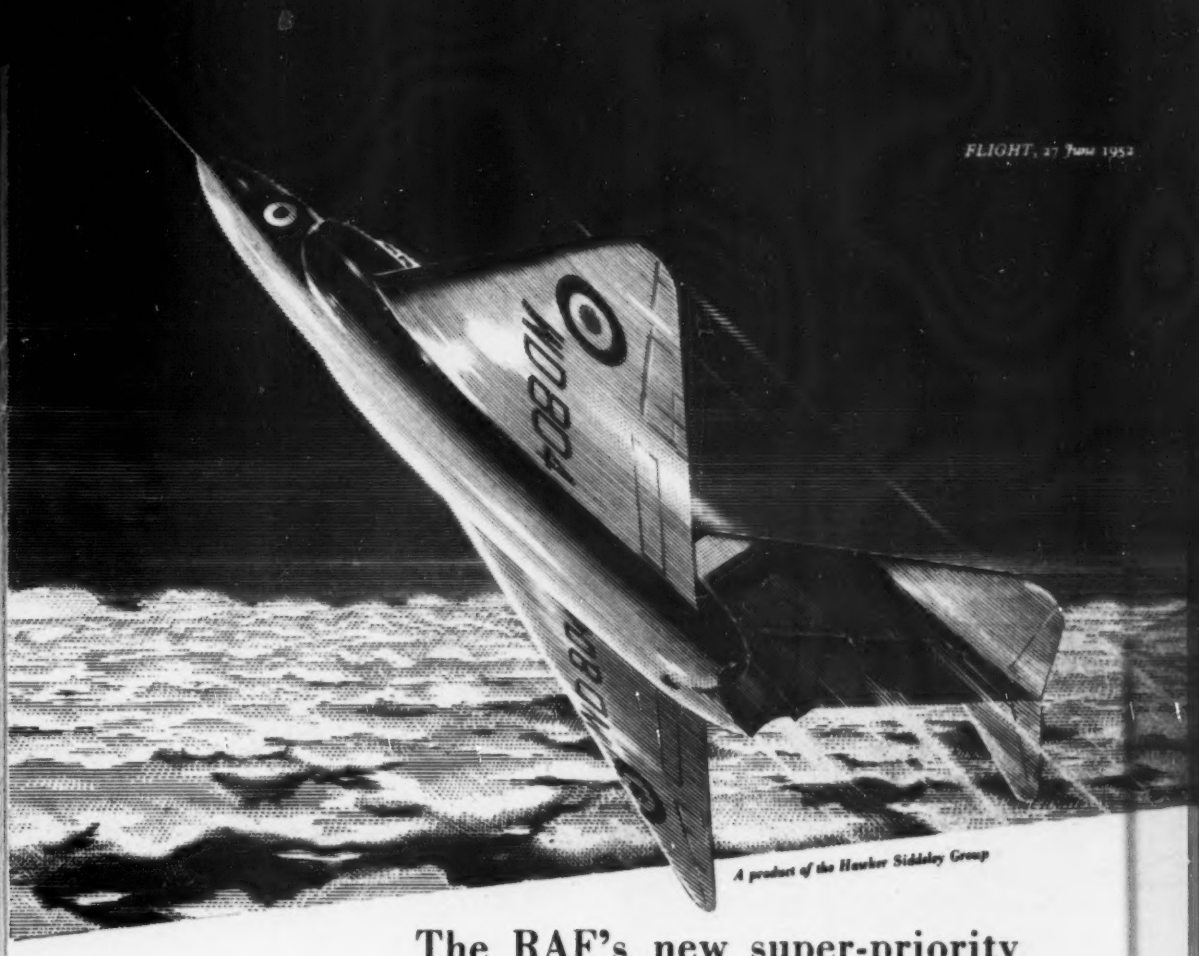
Williamsons state that they have a large development programme of new projects to meet the changing conditions of Service air photography, and have now further enlarged the additional factory acquired last year at Reading.

Mr. Odle was largely responsible for forming the successful Canadian subsidiary, of which he is a director. He is also a council member and hon. treasurer of the British Photographic Manufacturers Association, and chairman of the Executive Committee of the newly formed Photogrammetric Society.

## FOR RETAINING PIPES AND CABLES



*Metal-to-metal contact is eliminated in the Clatonrite Anti-Vibro Clip; a special oil-resisting rubber is used in this device, which can be supplied in steel or aluminium to take pipes with nominal diameters from 1/8in to 2 1/2in. An electrical earthing pattern is also available. The clip is produced by Howard Clayton-Wright, Ltd., of Wellesbourne, Warwickshire.*



*A product of the Hawker Siddeley Group*

# The RAF's new super-priority all weather fighter

*Two Sapphire turbojets for unbeatable power*

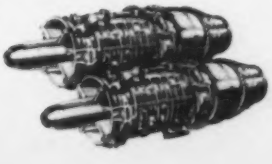
*High mach number with proved docility at low speed*

*Britain's first operational delta-winged aircraft — "the best night fighter in the world"*

*Capable of continuous development in many roles*

## GA·5 GLOSTER AIRCRAFT

ENGINES BY ARMSTRONG SIDDELEY



# More power to the Comet

Capacity payload on the
very long stages of world travel

## DE HAVILLAND

Comet Series 2. Rolls-Royce Avon Jet Engines

# WINGED FEET for the TROOPS

## *Airwork Inaugurate Hermes Trooping Service*

*The vanguard of many. Troops boarding the first Airwork Hermes to leave Blackbushe for Malta en route for Fayid in the Canal Zone.*

"FLIGHT" Photographs

*In charge of the aerial troopship: (Left to right) Lt.-Col. D. Humphrey, C.B.E., Col. B. J. O. Burrows, O.B.E.; and G/C. A. G. Miller, D.F.C., manager of Airwork's air transport division, who accompanied the troops.*

*(Above) On the Airwork service, china cups and supper-boxes served by air hostesses replace the cardboard mugs of Transport Command. (Below) Sixty-eight troops make a goodly load for a Hermes. Even the hostess seems a trifle perplexed at having so many men on her hands. Because civilians are not allowed to land at Fayid, the hostesses go no further than Malta. For the same reason all the aircrew hold Reserve commissions and wear R.A.F. uniform.*

LAST year, Airwork, Ltd., were awarded a trooping contract worth £1¼ million, which enabled them to purchase five Handley Page Hermes IVs from B.O.A.C. Considerable modifications have been made to the aircraft. The Series 763 Bristol Hercules engines have been replaced by those of the Series 773, in order that fuel of a lower octane number may be used, and the seating arrangement has been entirely altered. For trooping, the Hermes now have 68 rearward-facing seats—an arrangement which can be quickly altered to 59, 47 or 40 for civil work, should occasion demand. In view of the size of the trooping contract, however, it is very unlikely that the Hermes will carry civilian passengers in the near future.

The first modified Hermes, G-ALDB, was delivered to Airwork some weeks ago, and immediately flown to Khartoum for tropical trials. This is the aircraft depicted on this page; the photographs were taken when at the inauguration of the trooping service from Blackbushe to the Canal Zone on Tuesday evening, June 17th. Delivery of the other four Hermes is expected shortly, and when they are available Airwork expect to run an almost nightly service *via* Malta to Fayid, in the Canal Zone. This is the first employment of pressurized aircraft for trooping purposes by Britain, but the Americans did pioneer work with Constellations during the war, and with Strato-freighters.

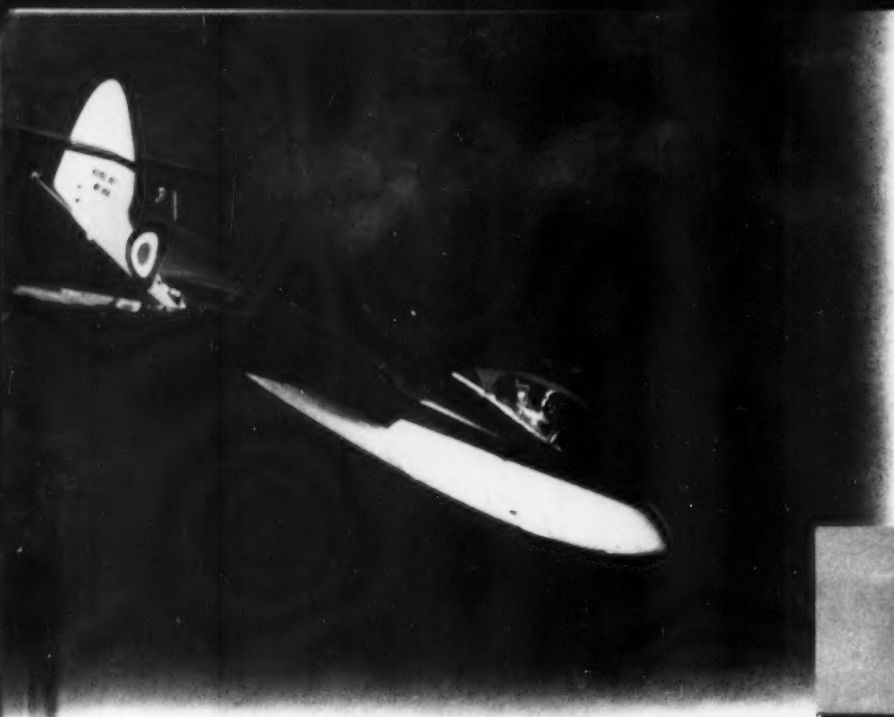
An interesting sidelight on the cost of trooping was revealed in the House of Lords debate on civil aviation when the Air Minister stated that it was now cheaper to fly a man to the Middle East than to send him by sea. Apart altogether from the speed, he thought there was a saving of £4 per man.

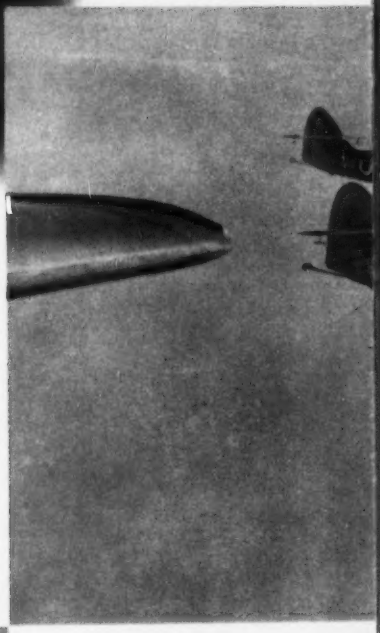
This is the second new service to be started by Airwork recently. On Saturday, June 14th., in conjunction with Hunting Air Travel, they opened the "C-rate" Safari service (for the public) between London and Nairobi, using Vikings.

In the two lef
Sea Hawk cock

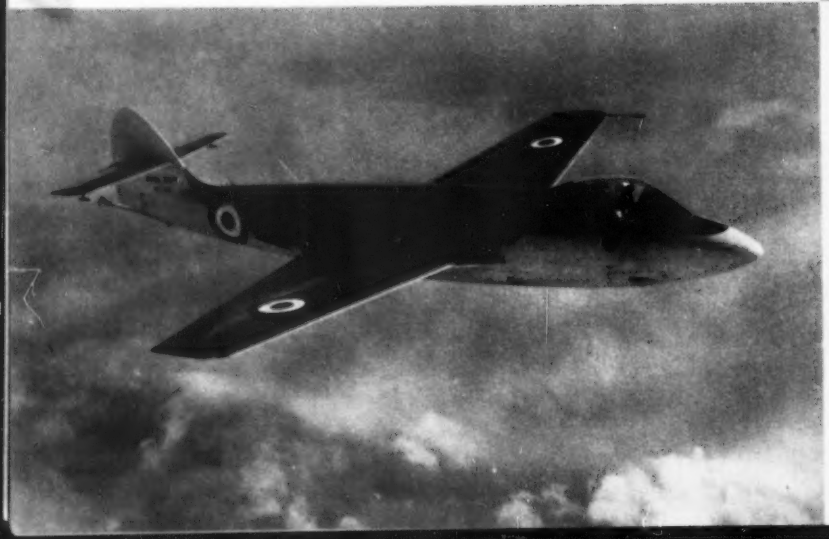
Half-rolling a
displays its p
two prototype
has been

(Below) Like o
Hawks slip p





# SEA HAWK

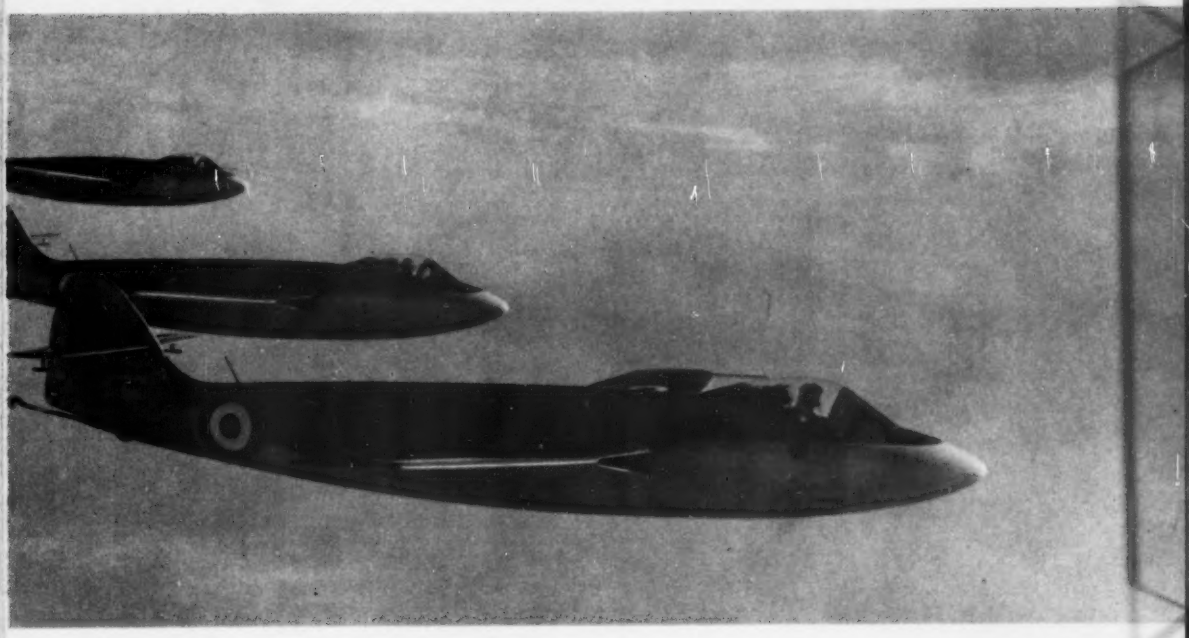


*From a Great Lin*

*-hand views the production-type
pit enclosure and various aerials
are prominent.*

*way, on the right, a Sea Hawk
dian-form. Compared with the
(VP413 and VP422) the span
slightly increased—to 39ft.*

*exotic fish, three production Sea
ast the photographic aircraft.*



# *ıe of Sea Fighters comes the Newest Single-seater for Naval Service*

"ONE of our Sopwith pusher seaplanes," writes Air Chief Marshal Sir Arthur Longmore, in his absorbing autobiography *From Sea To Sky*, "had a 1½-pounder gun weighing 265 lb mounted in the nose of the nacelle. . . ." The year of this pioneer experiment with heavy ordnance was 1914, and to the old Sopwith gun-bus the ancestry of the Hawker Sea Hawk F.1 naval fighter, production models of which are the subjects of Cyril Peckham's studies on these pages, can be traced. Later, a Sopwith Pup became the first aircraft to make a successful landing on the deck of a ship at sea; a Naval Camel, having taken off from a destroyer-towed lighter, sent Zeppelin L.53 flaming into the Heligoland Bight; and a Beardmore-converted Pup was the first machine to have folding wings *and a retractable undercarriage* for carrier stowage. Then, after the passage of years, came Sydney Camm's Hoopoe, forerunner of the better-known Nimrod; the two-seater Osprey; the Sea Hurricane—scourge of the Focke-Wulf commerce raiders; the Sea Fury, which has been hitting the Korean Communists where it hurts most; and now the Sea Hawk, powered with a Rolls-Royce Nene and probably capable of over 600 m.p.h.

# DESIGN FOR ZERO "G"

By K. W. GATLAND

## *A Man-carrying Rocket for Physiological Research in Near Space*

**IN the March 14th issue of "Flight" there appeared an article by L. N. Thompson entitled "Man Without Gravity," which dealt interestingly with many of the physiological and psychological problems associated with space-flight. In the article on this and subsequent pages, Mr. Gatland has dealt with the complementary mechanical problems of achieving space-flight, and discusses the proposals for a man-carrying research rocket which were put before the M. o. S. by R. A. Smith and H. E. Ross in 1946.**

IN the United States, upper-atmosphere research has been extended to include investigations into the physiological effects of rocket flight. Announcing this development on March 19th, 1952, Dr. J. P. Henry of the U.S.A.F. Aero-Medical Laboratory at Dayton, Ohio, said that in experiments conducted at the White Sands Proving Ground in New Mexico, five monkeys and several mice had ascended in A-4 and Aerobee rockets to heights of 40 and 80 miles. The main purpose of these tests was to study the medical effects of weightlessness arising from flight above the atmosphere.

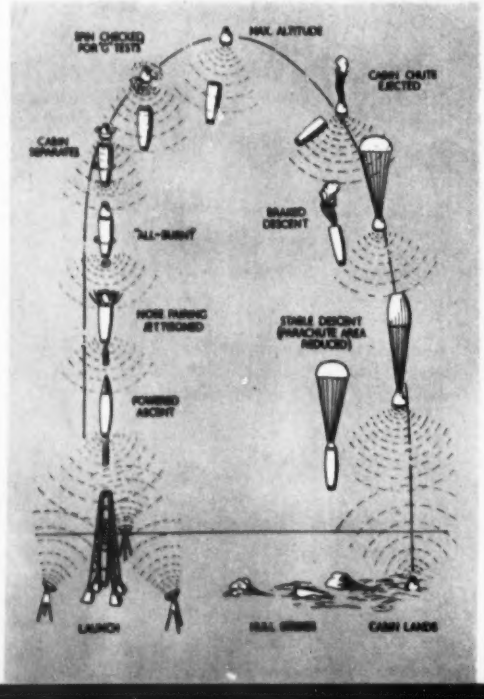
It is important to realize that the condition of weightlessness has nothing to do with a body being "beyond the influence of gravity." It will occur near the Earth equally as in deep space when a rocket is moving in "free fall" (i.e., coasting in space with power off) simply because, in a vacuum, the acceleration due to gravity is no longer being opposed. The phenomenon has already become apparent in altitude tests made with the Douglas Skyrocket, the U.S. Navy's supersonic research aircraft which has reached heights in the neighbourhood of 15 miles under rocket power. It is evident that such aircraft, capable of making short hops into space and gliding back through the atmosphere, will provide a valuable initiation to the conditions of space-flight.

The need for obtaining accurate information on the physiological effects of weightlessness was recognized at an early stage by two British designers, R. A. Smith and H. E. Ross, who submitted detailed proposals for a man-carrying research rocket to the Ministry of Supply in 1946.

The project was advanced as the most direct means of obtaining information necessary to the development of specialized supersonic research whilst at the same time confining the experiment to those fields in which it was considered that expenditure would have to be made within a decade. The opinion of the designers was that construction of such a vehicle represented the best opportunity for British research to take the initiative in what promised—and still promises—to be a highly competitive field of development with both military and scientific implications.

*This proposal for a man-carrying rocket, to investigate problems of space-flight, was put before the Ministry of Supply in 1946 by R. A. Smith and H. E. Ross. The general arrangement is detailed on page 775.*

*Man-carrying rocket: Schematic diagram of operating sequence.*




The overall purpose of the project was outlined as follows :—

(a) To provide experimental data on the effects on a human being of certain conditions of rocket flight—in particular, variations in gravitational datum over a wider range than can be obtained by any other means.
(b) To gain experience of conditions required to maintain manual control of rockets in powered ascent.
(c) To demonstrate the possibility of returning a pressure cabin and occupant to the surface of the Earth from extreme altitude.
(d) To determine the effect on human beings of a short period of exposure to conditions arising from lack of a surrounding atmosphere.
(e) To check by direct human observation the interpretation of instrumentally obtained high-altitude data.
(f) To carry out experiments with pulse transmission of telephone speech from a height of up to 225 miles, through the ionized layers existing below this level, checking fading, distortion and directional aberration under various atmospheric conditions.
(g) To obtain spectrographic records of the solar photosphere with greatly reduced interference from Earth's atmosphere.
(h) To obtain a better estimation of the extent of the solar corona.

The conception of the manned rocket (Fig. 1) was based on the German A-4; it was larger but incorporated the same basic propulsion unit. The most obvious point about the design is that there are no tail fins, the reason being that the efflux vanes are adequate to maintain a vertical path; and, since the rocket would be far from the correcting influence of airstream vanes at the time of "burn out," fins would incur nothing but unnecessary weight and drag. It was, of course, a different matter in the case of the A-4, when it was important that the missile possessed "arrow stability" as it fell towards its target.

An initial thrust of 60,000 lb was specified, the acceleration beginning at 9.8 ft/sec$^2$. The consumption of propellant and the corresponding decrease in weight would naturally increase this figure as the rocket climbed higher and, after it had travelled for 110 sec, the effective acceleration would be 2g. Adding the natural gravity datum, the pilot would be exposed to an apparent acceleration of 3g. This was regarded as the safe limit for a man to be fully active to his controls and when it was reached, the thrust

*The Percival Prince fitted with Alvis Leonides engines*

ALVIS

LEONIDES

ALVIS LIMITED, COVENTRY, ENGLAND

# A Special Announcement to Airline Operators all over the world

Airline Operators periodically replace their fleets of Aircraft with more modern types, and then find themselves saddled with the expense and trouble of disposing of their obsolescent machines.

*Why not use the Services of Airwork Ltd.?*

Airwork will offer you the best terms for your EXISTING Fleet in part exchange for whatever new types of aircraft you may wish to buy.

We have successfully negotiated similar transactions with major operators since 1936.

AIRWORK LIMITED

AIRCRAFT SALES DIVISION · AIRWORK LTD · 15 CHESTERFIELD STREET · LONDON W.1

Telephone GROsvenor 4041

## DESIGN FOR ZERO "G" . . .

would be progressively reduced, in conjunction with a g-meter, to keep the value constant.

It might be mentioned also that, should the occupant at any time lose consciousness, control would be taken over entirely by an autopilot working on microwave pulses from the ground by which means the observer would be brought automatically to a safe landing.

The observer occupies the space in the rocket's nose, and within his pressurized cabin he would have no external vision during the first two minutes of flight. It will be seen from the drawing that the cabin is a self-contained unit inside the nosing and that the external skin local to it is split into separate panels which jettison : the design is such that after a predetermined distance had been travelled, a compressed-air device would catapult the cabin away from the body of the rocket.

It was reasoned that separation should occur just after the climax of the thrust period, when the velocity had risen to about 4,700 m.p.h. From the moment power cut out, the efflux vanes would be incapable of producing reaction in the rocket nozzle so that the torque offered by the turbine (which was positioned to rotate about the rocket's major axis) would be relied upon to build up spin. The turbine unit would, of course, continue to be fed by the steam generator despite the fact that the propellant pumps which it normally drove were no longer required to operate.

The rate of revolution would thus steadily increase until it reached the figure at which centrifugal force acting on a datum line passing through the pilot's body produced 32.2 ft/sec² radial acceleration. At that point, the steam supply to the turbine would be cut, involving a slight decline in the rate of spin due to bearing resistance in the turbine. When the spin was at maximum, the nose fairing sections would part and be thrown off due to the inertia forces acting upon them so that, at any moment subsequent to their removal, the pilot could operate the control which drove the cabin away from the rocket. This control would also initiate a time mechanism for the ejection of the hull parachutes.

The cabin would be constructed almost entirely in light alloy, the walls embodying two viewing and access ports provided with shutters as protection from the fierce and unrelenting glare of the sun above the atmosphere. It was suggested that the observer's personal equipment should be an anti-g suit, a standard high-flying suit, a parachute and oxygen apparatus. A specially designed cradle-seat is provided in the scheme on which all instruments and control boxes are grouped so that it would be possible for the occupant to change his attitude in the cabin and still have all controls ready to hand. This is important in view of the experiments to be performed and one of the new devices embodied is a "strobo-periscope," which permits an apparently stationary external field of vision to be obtained from the rotating cabin.

Once the motor had ceased thrusting, the pilot would be no longer pressed down into his seat and would become subject to a very changed condition of gravity. Travelling in a high trajectory and freed from appreciable air-drag, he may be regarded as moving in uniform obedience to the combined forces of momentum and gravitation and, if the spinning of the cabin were completely annulled, the observer would experience a condition of "weightlessness" : nothing in the cabin would displace relative to anything else.

Probably the nearest approach to "zero gravity" so far experienced is in "delayed drop" parachute jumps, where the initial drop is made from a height at which the air density is small. This same condition of reduced weight is incurred for a short time, when the parachutist is accelerating freely. However, as air drag builds up, "free fall" no longer obtains and, as terminal velocity is approached, the sensation of weight slowly returns to normal. The critical period in this case is short-lived and in no way can it be taken to infer that this would be of sufficient duration to permit valid inferences to be drawn. What would be the result of prolonged periods of zero-gravity or even of a reduced gravity is simply not known.

This explains more readily why it is necessary to impart the axial spin, which results in "artificial gravity" simulated by centrifugal force. It is obvious that during those periods when the pilot in his cabin is either ascending or descending through air of very low density he will be able to conduct experiments with varying degrees and periods of "weightlessness." Small peroxide-permanganate motors firing tangentially from the cabin at right angles to the major axis would provide the means of rotational control. The time available for test would be about seven minutes, after which the "limited drag" parachute, stowed above the cabin, would release and bear the pilot to earth.

(*Continued on page* 779).

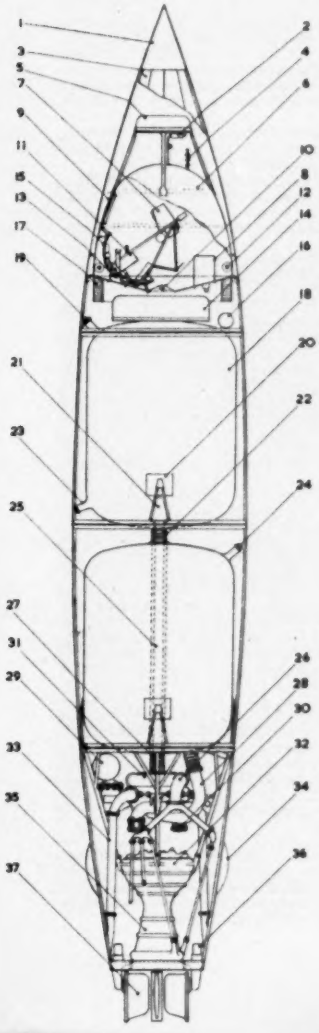


*Fig. 1. Longitudinal section of man-carrying rocket, showing general assembly.*

(1) *Nosecap.* (2) *Compressed-air bottle.* (3) *Nose fairing.* (4) *Antennae.* (5) *Parachute pack.* (6) *Pressure cabin.* (7) *Instrumentation.* (8) *Power-pack and transceiver.* (9) *Entrance port.* (10) *Dipole reflector.* (11) *Control boxes.* (12) *Spin motor.* (13) *Strobo-periscope.* (14) *Carcase parachute.* (15) *Adjustable seat.* (16) *Compressed-air bottle.* (17) *Crumple skirt.* (18) *Alcohol tank.* (19) *Vent.* (20) *Support bracket.* (21) *Servo valve.* (22) *Flexible coupling.* (23) *Alcohol filling-point.* (24) *Vent.* (25) *Alcohol feed-pipe.* (26) *Alcohol distribution manifold.* (27) *Flexible coupling.* (28) *Oxygen intake.* (29) *Steam generator.* (30) *Oxygen distributor-head.* (31) *Turbo-pump unit.* (32) *Combustion chamber.* (33) *Turbo exhaust.* (34) *Dipole blister.* (35) *Venturi.* (36) *Servo-motor.* (37) *Guide vanes.*

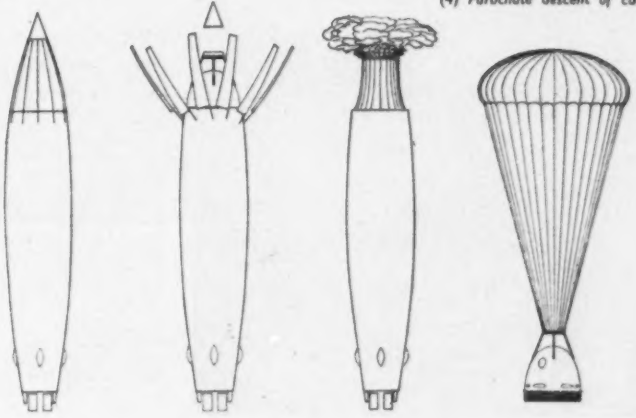


*Fig. 2. Operating sequence : (1) Rocket in powered ascent. (2) Climax of powered ascent (disposal of fairing). (3) Ejection of cabin and carcase parachute. (4) Parachute descent of cabin.*

*Four members of the British party, photographed at Newhaven last week on their departure for Spain. Left to right: C. J. Herold, Robin Fender, Philip Wills and Jock Forbes.*

# WORLD GLIDING CHAMPIONSHIPS

## *Britain's Chances in Spain Next Month: The Entries*

THE 1952 World Gliding Championships begin in Madrid next week. The record entry—which includes a strong British team using all-British equipment—makes this the most important gliding contest ever held.

The only international contest held before the war was at the Wasserkuppe in Germany in 1937. Since the war the Championships have become biennial, and have been held (in 1948) at Samaden in Switzerland, where 10 nations entered 37 pilots, and (in 1950) at Orebrö in Sweden, where 13 nations entered 34 pilots. The entry this year for the Championships at Madrid has reached 62, from 18 countries.

The British entry—captained, as in 1948 and 1950, by Mrs. Ann Douglas—consists of five pilots, all of whom will fly the new British Slingsby Sky sailplanes. Philip Wills, Lorne Welch and Jock Forbes flew in 1948 and 1950, but Frank Foster and Geoffrey Stephenson are newcomers to international contests, though they have often distinguished themselves in our National Gliding Championships.

Philip Wills, who also flew in the 1937 contest, has been a leading figure in British gliding for eighteen years. He is chairman of the British Gliding Association and holds the British goal-and-return record of 163 miles. He has held the British distance record four times and the height record five times. His retrieving will be in the capable hands of his wife, and they have already visited Spain to find out what is in store for them. His Sky is appropriately coloured blue.

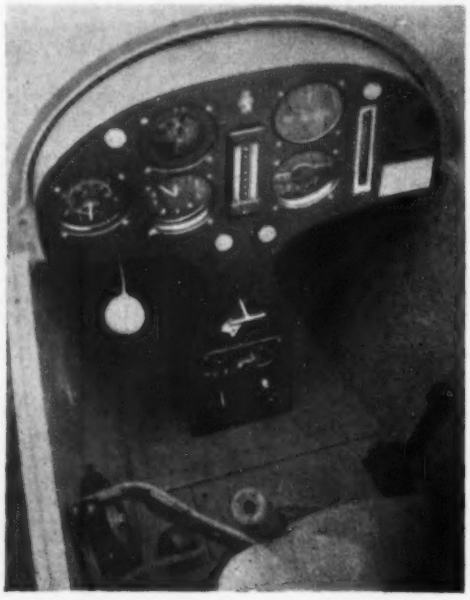
Jock Forbes, who is the present British champion, formerly held the British goal-flight record with 192 miles (in Germany) and was our most successful contestant in Sweden in 1950.

Lorne Welch, until recently chief instructor at the Surrey Gliding Club, has some brilliant cross-country flights to his credit. They include a Channel crossing (*en route* from Redhill to Brussels) and a cross-wind flight of 186 miles at the 1951 British Championships.

The two newcomers, Geoffery Stephenson and Frank Foster, are members of the London Gliding Club at Dunstable, and both have the assistance of wives skilled in trailer driving. Stephenson, in April 1939, was the first British glider pilot to soar to France. Although he is confined all the week to a London laboratory, his week-end flying has kept him in the front rank, and he was runner-up in the 1951 British Championships. Forbes, Welch and Stephenson will all three be flying Sky sailplanes, the colour of which is variously described as "tomato" or "orange." Frank Foster, on the other hand, is the proud pilot of the crimson Sky which hung in the South Bank Exhibition in 1951. Foster is a B.E.A. Elizabethan captain who spends his leisure time in flying gliders, and his performances in his own, pre-war-built sailplane augur well for his chances in Spain. Our reserve pilot, David Ince, will join Frank Foster's crew if not required to fly.

The equipment used by the team will be all-British and should be a fine advertisement for our products. The Slingsby Sky sailplane proved itself in the 1951 British Championships and the pilots who have been practising with it are full of praise for its handling qualities. The disposable load of 250 lb has allowed them to install their own pet equipment. All have fitted blind-flying instruments, anti-icing pitot heads and oxygen equipment, and will be prepared for any weather. Pye walkie-talkie radio sets will enable the pilots to talk with their ground crews and this facility should greatly shorten retrieving time, while the information which the ground crew may be able to pass to the pilot should be of assistance to him. The ground crews will be comfortably installed in the five blue Vanguard estate cars loaned by the Standard Motor Company.

The contest is to take place at the airfield of the Royal Spanish Aero Club near Madrid. All take-offs will be by aero-tow and the task of getting the sixty-odd competitors airborne within a reasonable period each morning is an organizational problem of the greatest magnitude. One of three tasks will be set on each contest day: (i) a free distance-flight, or (ii) a flight to a goal chosen by the pilot, or (iii) a race to a goal fixed by the organizers.



*The cockpit of the Sky. Instrumentation consists of A.S.I., altimeter, compass, Cobb-Slater variometer, Horn variometer, turn-and-bank indicator, and fore-and-aft level. At the bottom of the panel is the oxygen control, and the knob on the left is the tow release. Tail-trimmer and undercarriage-jettison lever can also be seen.*

*One of the Sky sailplanes, as seen at Dunstable recently.*

The congestion which might occur at the Madrid end has ruled out goal-and-return races, so that each flight will end with a retrieve. Air retrieves from certain goals will be allowed. The marking system makes allowance for variation in pilots' performance and the weather by adjusting the marks earned each day to give the winner 1,000. The best performances by a pilot while attempting each of the three tasks will be added to obtain the general classification. A pilot winning all three tasks would thus score 3,000 marks.

Although the airfield is 2,000 ft above sea level, the daily temperature will probably reach 90 deg F and it is not surprising to learn that, if clouds do develop, thunderstorms can be expected. In such conditions thermals will start early.

The list of competitors shows that many are veterans of previous contests. They include Nilsson (Sweden) and MacCready (U.S.A.), who finished first and second two years ago; Dick Johnson (U.S.A.), holder of the world distance record of 535 miles, who will be flying his RJ5, which has the lowest drag-coefficient of any aircraft now flying; and Laroy Mansson (Sweden), who holds the world out-and-return record of 245 miles. The German team includes Max Beck, who won the 1937 German contest and Hanna Reitsch, Luftwaffe pilot and friend of Hitler.

Several new gliders will be seen at Madrid. In addition to the British team, the Argentinians and the Dutch will be flying the Sky. Two Horten XV tailless two-seaters will also be flown by the Argentinians, and the Germans are bringing three post-war two-seaters.

In spite of the strong competition, there is every hope that Great Britain will greatly improve on the lowly positions she held in 1948 and 1950. A.H.Y.

### THE ENTRY-LIST

**Argentine** (two Skys and two Horten XV two-seaters).—R. Bazet, J. Cuadrado, M. García, J. Ortner, F. Rossi.
**Belgium.**—Gildemyn.
**Canada.**—F. Brame (Weihe), R. Noonan (Weihe), B. Jeffery and F. Woodward (Kranich two-seater).
**Denmark.**—Peddersen, Rasmussen,† Wermouth.
**Egypt.**—Kamil.* †
**Finland.**—M. Kahra, A. Koskinen, P. Saarli, H. Tandefelt.
**France.**—Branswych, M. Gasnier, H. de Lassageas, Marbleu, G. Pierre.
**Germany.**—M. Beck (Weihe), E. Frowein (Bergfalke two-seater), E. G. Hasse (Condor IV two-seater), H. Kensche (Kranich III two-seater), Hanna Reitsch.
**Great Britain.**—R. C. Forbes* † (Sky), F. Foster (Sky), G. Stephenson (Sky), L. Welch * †(Sky), P. A. Wills* † (Sky).
**Holland.**—J. Koek (Sky).
**Italy.**—Five pilots.
**Norway.**—Haydn†.
**Portugal.**—D. Grancha, V. Ribeiso, A. da Silva.
**South Africa.**—H. Lasch.†
**Spain.**—Five pilots.
**Sweden.**—T. Lof,† L. Mansson, W. Nilsson.†
**Switzerland.**—K. Fahrlander,* A. Gehriger,† A. Kuhn* and H. Nietelspach (two-seater), M. Schachenmann.*
**United States.**—W. Beuby, R. Johnson (R.J.5), P. MacCready,† S. Smith, P. Schweizer.

**British Pilots and Ground Crews**

| Pilot | Ground Crew |
|---|---|
| F/L. R. C. Forbes | C. J. Herold, W. Brookfield, Cpl. Gough. |
| Frank Foster | Pat Foster, Jack Lang, David Ince. |
| Geoffrey Stephenson | Beryl Stephenson, Hugh Latto, Allan Pratt. |
| Lorne Welch | Frank Irving, Mike Neale, Geo. Gregory. |
| Philip Wills | Kitty Wills, Robin Fender, P. Haley. |

* Competitor in 1948. † Competitor in 1950.

## AT THE A.R.B. ANNUAL LUNCHEON

*Seen above are most of the guests at Londonderry House on June 19th, when Lord Brabazon read the annual report of the Air Registration Board.* On the left (reading clockwise) are: Mr. F. E. N. St. Barbe, de Havilland director, and council member, A.R.B.; Mr. E. C. Bowyer, director, S.B.A.C.; Sir Frederick Bowhill, M.C.A.; Sir Geoffrey de Havilland; Capt. A. G. Lamplugh, British Aviation Insurance Co. director, and council member, A.R.B.; Sir Hew Kilner, Vickers-Armstrongs managing director; Capt. M. J. R. Alderson, B.O.A.C., and council member, A.R.B.; Air Marshal Sir J. N. Boothman, M. of S.; Mr. A. G. Elliott, Rolls-Royce director, and council member, A.R.B.; Mr. P. G. Masefield, B.E.A. chief executive; Sir A Rowlands, Perm. Sec., M. of S.; Mr. W. M. Evans, chief engineer, A.R.B.; Sir Stanley Aubrey, Lloyd's; Mr. G. F. Johnson, vice-chairman, A.R.B.; Mr. E. B. Ferguson, British Insurance Association chairman; Lord Douglas of Kirtleside, B.E.A. chairman, and council member, A.R.B.; Sir Arnold Overton, M.C.A.; Mr. J. D. North, Boulton-Paul managing director and council member, A.R.B.; Sir Archibald Hope, Airwork, Ltd.; Sir Frederick Handley Page, vice-chairman, A.R.B.; Mr. A. T. Lennox-Boyd, Minister of Civil Aviation (guest of honour); Lord Brabazon of Tara, chairman, A.R.B. In the right-hand view, seated on the left of Lord Brabazon, are, in addition to those mentioned, the Viscount Knollys; Sir Maurice Denny, vice-chairman, A.R.B.; Mr. R. Maudling, M.C.A.; Mr. Whitney Straight, B.O.A.C., and council member, A.R.B.; Mr. A. A. Hall, director R.A.E.; Mr. Thurstan James, editor *The Aeroplane*; Maj. R. H. Thornton, B.O.A.C., and council member, A.R.B.; Mr. C. C. Walker, de Havilland director; Mr. J. Norman, chief surveyor, A.R.B. The other guests, not shown here, were: Sir George Cribbett, M.C.A.; Mr. A. B. Stewart, vice-chairman, A.R.B.; Mr. J. E. Keel, M.C.A.; Mr. R. E. Hardingham, chief executive, A.R.B.; A. Cdre. Vernon Brown, M.C.A.; Mr. H. E. Wortham, *Daily Telegraph*; Mr. J. E. Rylands, Lancashire Aircraft Corporation director, and council member, A.R.B.; Mr. G. Hutchinson, *Evening Standard*; Mr. F. W. A. Pasmore, assistant secretary, A.R.B.; Mr. W. Tye, chief technical officer, A.R.B.; W/C. Maurice Smith, editor, *Flight*; Col. R. L. Preston, R.Ae.C., and A.R.B. council member; Mr. E. R. H. Hill, Lloyd's, and council member, A.R.B.; Mr. J. J. Taylor, council member, A.R.B.; and Mr. W. T. Gill (Rolls-Royce), president of the S.B.A.C.

# HIGH-SPEED AERODYNAMICS

## —at the N.P.L.: Progress Reviewed in Annual Report

AMONG the best values for money offered by Her Majesty's Stationery Office is the annual report of the work of the National Physical Laboratory. The report for the year 1951 is now available, a 70-page publication priced at 3s (by post 3s 2d), and it gives condensed surveys of the work of the several divisions which together make up the establishment.

The Aerodynamics Division has been mainly engaged during the year on basic research for the Ministry of Supply, particularly on new aerodynamic problems connected with the design and performance of high-speed aircraft. Investigations have also been made for the Admiralty, the Ministry of Transport, research associations and private firms.

Progress has been made on the scheme to provide the new wind tunnels needed for future research. The plans made for the new High Speed Laboratory on the West Aero Site are now being implemented. Work on a building to house three 500-h.p. compressors has started. The first high-speed wind tunnel (36in by 14in) is being made and a contract for the second tunnel (25in by 20in) has been placed. A tentative layout for a new low-turbulence pressurized wind tunnel (8ft by 6½ft) has been prepared.

As in past years, close liaison has been maintained with the Royal Aircraft Establishment and with the aircraft industry for exchange of views on current aerodynamic research and its bearing on aircraft problems.

Experiments have continued on the maintenance of laminar flow on an aerofoil by withdrawing boundary-layer air through porous material. The new thin nose-slot aerofoil designed for high maximum lift has now been tested in the 4-ft tunnel. With moderately large suction quantities the maximum lift coefficients obtained were not greatly different from those expected when the section was designed, but with the low suction quantities which it was hoped would be sufficient there was no improvement on previous designs.

The improvement of stalling characteristics by discharging air over trailing edge flaps has also been kept under review. Considerably increased maximum lift coefficients can be obtained by this means for both straight and swept-back wings, but power requirements for swept-back wings are likely to be rather large and the increased pitching moments may prove troublesome, particularly for tailless aircraft.

A systematic investigation of the aerodynamic characteristics of three swept-back wings of different aspect ratios has been started in wind tunnels. The object of the work is to provide information for modifying lifting-surface potential flow theory to allow for viscosity. Measurements in the boundary layers and wakes will be included. The basic aerofoil section of the model wings has been tested in two-dimensional flow to provide essential data to link with three-dimensional test results. A cambered version of the aerofoil has also been tested in two-dimensional flow to give values for the camber derivatives involved in wing-loading theory. Further tests of a symmetrical aerofoil on the Whirling Arm have also provided a measure of these camber derivatives. A critical comparison of routine methods for calculating the lift slope and aerodynamic centre of symmetrical two-dimensional aerofoils has been developed and described in a recent report. Calculations made for families of plan forms show the effects of compressibility and aspect ratio on the loading of swept wings; related wind-tunnel tests are being made to provide a link between theory and experiment. Calculations of compressible flow for aerofoils of various thickness-chord ratio are planned; allowance for wake effects and comparisons with wind-tunnel results are to be made. Much work has been done on wind-tunnel interference both for two- and three-dimensional models; tables are now available for computing, in particular, wind-tunnel interference for swept-back tapered aerofoils in closed rectangular tunnels. The effect of tunnel blockage at high subsonic speeds is being investigated by two-dimensional theory. Attention has been given to the use of high-speed computing machines for the solution of aerodynamic problems; for example, the ACE (Automatic Computing Engine) Pilot Model has been used to solve the large number of linear simultaneous equations which arise in wing-loading calculations.

Tables based on the approximate numerical method of aerofoil design are being prepared which will permit the calculation of the velocity distribution over the surface of a given two-dimensional aerofoil when its co-ordinates are specified at convenient chordwise stations, instead of at equal intervals of the angular co-ordinate in the conformal transformation. A technique for use in the exact method of design is being developed for obtaining a specified leading-edge radius of curvature. A catalogue has been prepared giving details of all aerofoil sections which have been designed at the N.P.L. and which have been the subject of theoretical investigations, aircraft design-studies or wind-tunnel tests.

Tests in the compressed air tunnel have confirmed that the maximum-lift characteristics on bluff-nosed aerofoils like the H.S.A. V aerofoil are very dependent on small changes in nose shape.

The programme of research on high-speed flow consists mainly of investigations designed to give information on fundamental problems and, where possible, comparisons with theory. Several such investigations have been made during the year. Considerable effort has also been devoted to the design and development of new techniques and apparatus.

Detailed studies of the flow round thin two-dimensional aerofoils at high subsonic speeds have been continued in the 20in by 8in wind tunnel, and work on aerofoils fitted with control flaps is to begin soon. The models are so constructed that transition from laminar to turbulent flow in the boundary layer can be fixed near the leading edge by allowing a minute quantity of air to flow into the boundary layer through a span-wise row of small holes. This technique enables tests to be made with either laminar or turbulent flow over most of the surface, and thus permits the scale effects associated with the low Reynolds numbers of the tests to be studied and minimised. The maximum angle of incidence used in tests in the 20in by 8in tunnels is usually sufficiently large for detailed information to be obtained on the flow changes which occur in the region of maximum lift coefficient. Further information on scale effect at high subsonic speeds is to be obtained by tests on an aerofoil in the 18in by 14in tunnel over a wide range of Reynolds number.

### Tunnel Development

An examination of tunnel-wall interference on a two-dimensional aerofoil at Mach numbers close to unity has been completed in the 9in by 3in tunnel, and the information obtained is to be used to extend the Mach number ranges of the 20in by 8in and 9½in by 9½in tunnels. The 9in by 3in tunnel has also been used at high subsonic speeds for photography of the flow round a two-dimensional aerofoil performing pitching oscillations similar to those in the damping measurements made in the 9½in by 9½in tunnel. The photographs show that the major difference between the steady and oscillatory flow is that of phase; the phase differences can be deduced from the direct measurements of damping and are found to be in reasonable agreement with those observed.

A small direct-discharge tunnel has been completed during the year. It operates at Mach numbers between 1½ and 4 with an intake pressure which can be varied between about ½ atmosphere and 20 atmospheres, to enable tests to be made over a wide range of Reynolds number. The tunnel is being used for an investigation of the interaction of an oblique shock wave of adjustable strength with the boundary layer on a flat plate at Reynolds numbers up to about 15 million. Measurements of the skin friction on the plate and of the boundary layer profile are to be attempted.

Further improvements have been made in the technique of schlieren photography, and, with the collaboration of the Electricity Division, in the design of short-duration light sources. Exposures down to about $10^{-7}$ second have been obtained and have proved to be particularly useful for examining the micro-structure of wakes.

The calibration of the 18in by 14in pressurized wind tunnel at subsonic speeds has been completed; the calibration at supersonic speeds is in progress. The ancillary equipment now installed includes manometers, a schlieren apparatus and a Mach-number gauge. A three-component balance using wire-resistance strain gauges is being constructed. Modifications and repairs to the 11in by 11in supersonic tunnel have continued throughout the year; a new working section and cooler have been constructed, and the control circuits have been re-designed. The re-blading of the axial-flow compressor is to begin shortly and it is hoped that the tunnel will come into service within the next six months. When the 18in by 14in and 11in by 11in tunnels are available for experimental work, the ranges of both Reynolds number and Mach number that can be covered will be increased appreciably; it will then be possible to do more work on bodies and aerofoils of finite aspect ratio than formerly.

# Do you know your airfields?

**23**

*Recognise this airfield? It's No. 23 in this series of puzzle photographs. You'll find the answer below on the right.★*

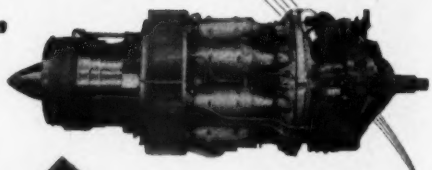
Lucky the aircraft operators—be they international airlines or week-end joy-riders—who use Shell and BP Aviation Service. The keen crews of the famous Aircraft Servicing Vehicles, on duty at twenty-six of Britain's aerodromes, are always glad and willing to take the refuelling work off everybody else's hands—yours included.

## Shell and BP Aviation Service

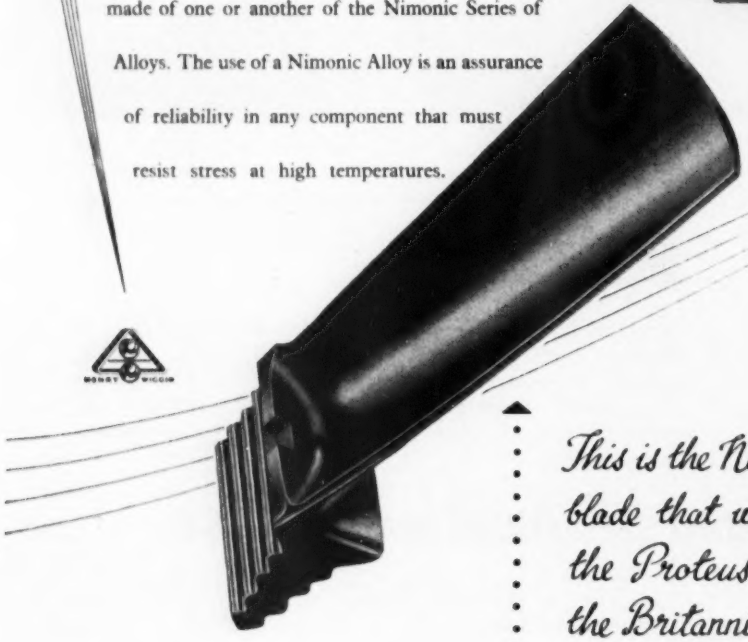
*Shell-Mex and B.P. Ltd., Shell-Mex House, Strand, London, W.C.2.*
*Distributors in the U.K. for the Shell and*
*Anglo-Iranian Oil Groups.*

★ Gloucester/Cheltenham (Staverton Airport)

# One good trademark leads to another



*Every* British aircraft gas turbine has rotor blades made of one or another of the Nimonic Series of Alloys. The use of a Nimonic Alloy is an assurance of reliability in any component that must resist stress at high temperatures.



*This is the Nimonic 80 turbine blade that will rotate in the Proteus that will keep the Britannia flying*

Nimonic is a Registered Trade Mark

**HENRY WIGGIN AND COMPANY LIMITED**

WIGGIN STREET · BIRMINGHAM · 16

## HIGH-SPEED AERODYNAMICS . . .

Experiments have been started on a half model of an arrowhead wing fitted with trailing-edge control flaps to test methods of estimation based on approximate theories. Tests on a complete model of the same wing are to be made to obtain checks on the theory of wind-tunnel interference and also on the method of estimating the effectiveness of anti-symmetrical elevons in the free stream from a tunnel test on a half wing.

Preliminary measurements of oscillatory derivatives for a wing-aileron-tab combination have been made on the multi-stage mechanical oscillator. Pressure distributions on an aerofoil with an oscillating flap are to be measured in the water tunnel and the results compared with theory. Measurements of pitching-moment derivatives on a two-dimensional aerofoil have been made at high subsonic speeds; the results show a drop in damping at the highest speeds.

Much attention has been given to the theoretical and experimental determination of stability and flutter derivatives for delta and swept-back wings. The derivatives appropriate to pitching and plunging oscillations of a delta wing for incompressible flow conditions have been given in a recent report. A theory for dealing with oscillating wings in high subsonic compressible flow has been proposed and fairly good agreement with experiment has been obtained. Further measurements of pitching-moment derivatives for delta and swept-back wings at transonic and supersonic speeds are to be made.

A survey of present knowledge of stability and flutter derivatives for wings in unsteady supersonic flow has been made. The pitching-moment derivatives for a particular delta wing which is to be tested at supersonic speeds are to be calculated for comparison with measured results. New apparatus has been designed for the measurement of oscillatory derivatives at high Reynolds numbers and frequency in the 18in by 14in high-speed tunnel.

A report has been issued on the correlation between the still-air resonance characteristics and the flutter characteristics of a model wing carrying concentrated masses representing engines. A scheme for the measurement of cyclically varying pressures has been developed with a view to determining the pressure distribution over oscillating aerofoils. It is proposed to apply this method for the measurement in a water tunnel of the pressures associated with an aerofoil carrying an oscillating flap.

An attempt is to be made to extend three-dimensional supersonic flow theories to include second-order effects. The behaviour of laminar boundary layers on bodies in unsteady motion is being investigated theoretically, to obtain a better understanding of viscous effects on aerodynamic derivatives for oscillatory motion, particularly for flap controls. A semi-experimental method for estimating oscillatory derivatives for a two-dimensional aerofoil at high subsonic speeds is being developed; it will take account of thickness and viscosity effects by making use of measured steady-motion characteristics. A second order theory has been proposed and used to calculate flutter derivatives for a biconvex aerofoil with flap in a supersonic stream. Theoretical work is in progress on wings of low aspect ratio in steady and also unsteady motion, including the effect of gusts. Preliminary results, obtained for very low-aspect ratio wings in incompressible flow, indicate that the initial value of the lift following a sudden change of incidence may be greater than the final value corresponding to steady conditions. The effect of tunnel walls on measurements of pitching-moment damping on oscillating two-dimensional aerofoils in subsonic compressible flow is being investigated.

A study has been made of the flow in a curved pipe with a bend radius of ten pipe diameters. Measurements of total-head distribution for sections at angles round the bend between 0 deg and 180 deg showed that the secondary flow had a maximum strength at about the 60 deg section and that it settled down to a quite small strength beyond the 90 deg section. A theoretical investigation has been made of the stability of thin liquid films, such as are used in atomizers to obtain a spray of fine drops. Breakdown occurs owing to the development of unstable waves which arise from the movement of the film through the air. The theory gives no indication of the actual size of the drops which are formed. A series of boundary-layer explorations has been made on the porous circular cylinder with Thwaites flap mentioned in the 1950 report. Theoretical estimates of momentum thickness agree well with those measured, but more detailed comparisons, such as velocity profiles and separation criteria, were not reliable because of the limited accuracy in the determination of pressure gradient over the surface of the model.

Traverses have been made in the boundary layer of a flat plate with total-head tubes of circular and rectangular cross sections to obtain information on errors due to the disturbances caused by them. The results obtained with the smallest tubes at various distances from the surface and at different air speeds were found to be in close agreement with the values given by a hot-wire anemometer. A new form of gauge, comprising a U-tube with an adjustable reservoir in one limb, possessing a sensitivity equivalent to a pressure head of 0.00001in of water and a volume considerably smaller than a 1in Chattock gauge, enabled the mean pressure given by the tubes to be accurately measured. A new mechanism has been made for exploring flow in the boundary layer and wake of a tapered aerofoil, which permits a total-head tube or a hot-wire anemometer to be traversed to a precision of about 0.002in and to be set in the stream direction to within 0.2 deg.

Several models of prototype aircraft with special design features have been tested in the compressed air tunnel. The wool-tuft technique has been used to study the flow around aerofoils; it appears that tufts can be used anywhere in the upper surface of some aerofoils without interfering with the flow pattern, whereas they affect the flow on other aerofoils, even when they are situated as far back as the mid-chord position of the aerofoil.

Measurements of stability and control derivatives of torpedo models have been made for the Admiralty in wind tunnels and on the Whirling Arm. Wind-tunnel experiments to assist in the design of submarines and aircraft carriers have been continued. Tests made for industrial firms have included anemometer calibrations and measurements on models of structures or objects exposed to strong winds. Tests on smoke clouds from ships' funnels and from power-station chimneys have been made on models in wind tunnels. Advice and assistance to Government establishments on problems involving measurements of low speeds in air and in water have been given. The experimental work on the aerodynamic stability of suspension bridges was completed early in the year by tests of a large scale section model to verify the stability of the design finally selected for the proposed Severn Bridge. The development of improved methods for the calculation of the elastic stiffnesses and natural frequencies of suspension bridges has also been completed. The large wind tunnel specially built for the investigation at Thurleight Airfield, Bedfordshire, has now been taken over by the Ministry of Supply.

Advice and assistance continue to be given to firms and organizations on wind tunnels, test plant, metering equipment and industrial aerodynamic problems.

## DESIGN FOR ZERO "G" (Continued from page 775)

Calculation has shown that the cabin could ascend over 200 miles; but, as 180 to 190 miles is considered the limit from which safe return can be expected using "limited-drag" parachute-braking alone, the apex of the flight would be timed to occur at about 180 miles. The rocket would have an all-up weight at take-off of 20.9 tons, of which 17.2 tons would be propellant—alcohol and liquid oxygen—and 1.29 tons taken up by the cabin and pilot. Thrust would be timed to last for 148 sec, after which would follow a period of ascent under momentum of 228 sec, so that the peak trajectory would be reached after 6 min 16 sec.

The actual detail design and construction of the rocket could not, of course, be undertaken until certain clearly defined preliminary conditions had been verified experimentally. These are, principally :—

(a) The development of a sufficiently reliable and controllable motor.
(b) Successful return to the surface of telecontrolled rockets from progressively increasing altitudes.
(c) Extensive practical experiment with handling controls and working in a mock-up cabin.
(d) Practical demonstration of successful parachute drops of a mock-up cabin.

Anyone with any experience of rocketry will immediately realize that the successful conclusion of these preliminary trials would each represent an independent development of intrinsic value. The man-carrying rocket, with special regard to the research leading up to it, would provide information of inestimable worth in a whole range of subjects related to hyper-flight, and would lay the foundation for a concerted military programme. There is the added advantage that the basis of the research is already existing in a rocket which has been successfully proved.

If the development of the various components proceeded concurrently, the initial programme would probably occupy five years. As the work approached its final stage, the intending pilot should be familiarizing himself with the construction, operation and control of the vehicle, and conditioning himself to the physiological reactions. On this latter question, the Ministry's view was that the effects of reduced gravitation on the human system were to a large extent "visualized."

Nevertheless, Smith and Ross remain convinced that experiments of the kind they suggest will in fact be required in order to secure positive data, and their project appears to embody many valuable features for a successful test vehicle. But it will, it seems, be left to our American contemporaries to produce one!

# CORRESPONDENCE

*The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.*

### Twin Booms

SINCE aircraft have been inflicting their shock-waves upon us, we have given the subject some thought. The following are our tentative conclusions.

An aircraft flying at sonic speed is at all times on the leading surface of the expanding sphere of pressure it is creating. It generates pressure which cannot dissipate in front of it.

Pressure builds up fairly rapidly to a point where dissipation due to distance roughly balances the energy being added, and thereafter remains almost constant (this is the shock-wave).

On slowing down, the aircraft leaves an expanding spherical shell of pressure, the intensity of which is greatest where it first touches the ground (assuming the dive to have been vertical). At this point the thickness of the shell is very small and the ear of the observer registers a high pressure over a short space of time as a bang.

A rough calculation indicates that if an aircraft accelerates through Mach 1 at 40,000ft, flies at an average Mach number of 1.02, and returns through Mach 1 at 20,000ft, two bangs will be heard about half a second apart; the second (made during acceleration) will be weaker, due to the distance it has travelled and the fact that it was made in air of low density.

Reports of one bang made recently over Hertfordshire came in from points as far apart as six miles.

Hatfield. JOHN P. and F. JAMES BUTTERS.

P.S.—Booms come in pairs around here!

### Atlantic Soaring?

PERHAPS the gliding experts among your readers would enlighten me on the following point: During the Northern Hemisphere summer (say, around mid-June) there is an almost uniform belt of low pressure extending across the Atlantic at, roughly, 10 deg North Lat., where heated air is continuously ascending and expanding. Is this belt "rideable" in a high-performance sailplane?

If it were, would it not be possible to "glide the Atlantic" from, say, Gambia in North-West Africa to Trinidad or Venezuela?

Dublin. TURLOUGH O'BRIEN.

### Late Sortie?

WHEN flying a few miles south of Peterborough recently (June 4th) at a height of 2,000ft, a lightplane pilot noticed a single-engined monoplane flying towards him. Subsequently the two machines passed quite close to one another and the pilot of the lightplane was surprised to see that the other aircraft was a Hawker Hurricane.

The latter machine had a bright red spinner, the usual R.A.F. markings and a light blue rudder. Thinking afterwards about this unusual occurrence, the pilot wondered whether in fact this Hurricane was the last of the few or merely a Portuguese immigrant back late from a sortie.

Since the film *Angels One Five* was finished some considerable time ago, there can be no connection between this incident and the fact that imported aircraft were used to make the Battle of Britain epic.

Which leads one to ask the question: "How many British Hurricanes are flying in this country today?"

Cambs. N. N.

### "Annie is a Lady"

FORMER staff of Imperial Airways will read with much pleasure and pride, in the above article on the Anson (June 6th), an acknowledgement by A. V. Roe and Co. that her design and construction was inspired by G. E. Woods-Humphery, then managing director of Imperial Airways.

Few today are aware how much the specifications issued to the aircraft industry between 1924 and 1939, and the civil orders placed by Imperial Airways, contributed ultimately to the efficiency and success of the R.A.F. How many know that the Short C-Class flying-boat, of which 28 were ordered by Imperials from off the drawing board for their Empire services, was the prototype for the Sunderland which, in the hands of Coastal Command, achieved such splendid results a few years later in the Battle of the Atlantic and in the defeat of the U-boat menace?

I recall a meeting of a Board committee taking a decision relating to an aircraft order, which afterwards led to Press criticism. Yet, unknown to Press and public, the decision (deliberately taken) was instrumental in preserving for later vital war production the design and drawing-office staff about to be dispersed for want of military orders during the lull preceding rearmament.

The old minute-books of Imperial Airways could reveal many instances indeed where the decisions of the Board, inspired by Woods-Humphery, later contributed directly and indirectly to the safety and welfare of Britain and the Commonwealth.

Time marches on; reminiscences become tedious—tomorrow's problems are not solved by yesterday's events. Nevertheless, history furnishes inspiration.

London, W.1. A. J. QUIN-HARKIN.

### Courtesy Title

MAY I be permitted to make this belated reply to a letter appearing in your issue of April 11th, on the grounds that I am at present on duty in the U.S.A. and so only receive your worthy journal several weeks after it appears in print?

I feel that I must hasten to the defence of the Admiralty in their release of the statement that I was at one time holding the position of Chief Naval Test Pilot at the Royal Aircraft Establishment. Actually the Admiralty received this statement in 1950 from the late Mr. W. G. A. Perring, who was then Director of the Royal Aircraft Establishment and who "vetted" my article on *Naval Test Flying* in its original form.

Mr. Perring had consistently used this courtesy title in his many communications with me during my protracted tour of duty at R.A.E., and so I feel Lt. Innes should stand corrected in view of the approval of such high authority.

Patuxent, Md., U.S.A. ERIC M. BROWN, Lt-Cdr., R.N.

[The April 11th letter from Lt. Innes referred to an article written by Lt-Cdr. Brown, an Admiralty introduction to which designated the author as "Chief Naval Test Pilot at the Royal Aircraft Establishment." Lt. Innes queried the existence of any such post.—Ed.]

### Position Error

MAY I point to an incorrect caption applied to the photograph reproduced on page 712 of *Flight* issued on June 13th, 1952?

The illustration shows the Great Temple of Deir-El-Bahari, or Monastery of the North, which was built and adorned with statues, reliefs and inscriptions by Queen Hatshepsut, the sister, wife and co-regent of Thutmosis III, between the years 1495 and 1475 B.C.

The Temple of Ramses, known as Ramesseum, is located on the same plateau, about thirty walking minutes distant.

Liverpool, 14. L. G. MONK.

### FORTHCOMING EVENTS

June 27. London Aeroplane Club: Midsummer Dance, Hatfield.
June 28. R.N. Air Station, Eglington: Air Day.
June 28-29. Aéro Club d'Eure et Loire: Rally, Chartres.
June 28-29. R.Ae.C.: La Baule Rally.
June 29. Northern Heights Model Flying Club: Gala Day, Hawker Airfield, Langley.
June 30-July 13. International Gliding Contests, Spain.
July 4-7. Aéro-Club de Belgique: Control-line Models World Championships, Melsbroek, Brussels.
July 5-6. Aéro-Club de Touraine: Wines Rally.
July 5-7. R.Ae.C.: Deauville Rally.
July 6. Aéro-Club d'Auvergne: International Air Meeting.
July 6-13. Ailes Ardennaises: Air Fête.
July 10-14. Wakefield Cup Models Contest, Norrkoping, Sweden.
July 11-12. National Air Races, Newcastle-on-Tyne Municipal Airport.
July 19. Leicestershire Aero Club: Rally, Leicester East.
July 20-27. Aéro-Club d'Italia: International Air Week, Italy.
July 26. Royal Engineers' Flying Club: Air Day, Rochester.
July 27. R.A.F. Golfing Society: Match v. 2nd T.A.F., Bad Eilsen.
Aug. 2. "Daily Express" Challenge Trophy Race.
Aug. 2-3. "ILSY" Air Display, Ybenburg.
Aug. 3-4. S.M.A.E.: National Model Aircraft Rally, R.N. Air Station, Gosport.
Aug. 9-10. Skegness Airport: Display.
Aug. 13-17. Nordic A/2 Models Contest, Austria.
Aug. 15. Aéro-Club de Charente Maritime: Laleu and La Rochelle Air Meeting.
Aug. 15. Ailes Montluconnaises: Rally.
Aug. 16. Aéro-Club de Vendée: Sables d'Olonne Rally.
Aug. 16-17. Bembridge and Sandown Aero Club: Rally.

# CIVIL AVIATION

*AT LYDDA, the base of El Al (Israel Airlines), are seen the company's three Constellations and one of its DC-4s. As mentioned below, the airline connects Israel with New York and several European cities, and also operates the only service between Israel and South Africa.*

## DEMONSTRATING THE VISCOUNT 700

ON Saturday, June 21st, the prototype Vickers-Armstrongs Viscount 700 left Blackbushe for a demonstration tour of India, Pakistan and the Middle East. Among those on board were Mr. A. D. McN. Boyd, tour manager; Mr. S. Sloan, captain; Capt. W. J. Wakelin (B.E.A.) second pilot; Mr. D. Jones, navigator/radio operator; Mr. J. Leach, design engineer; Messrs. E. Walker and C. H. Spooner, airframe inspectors; Mr. S. Pickett, airframe engineer; Mr. J. Bray, electrical engineer; and Mr. S. Jones, Rolls-Royce engineer. G/C. L. R. Stokes, of the Rolls-Royce technical sales department, is to join the aircraft at Delhi.

On the return journey the Viscount is scheduled to call at airports in Iraq, Lebanon, Cyprus, Turkey and Egypt before reaching Blackbushe on July 25th.

During the tour demonstrations will be given to the Air Forces of India and Pakistan, and to several airlines, including Indian National Airways, Air India, Airways (India), Orient Airways, Iraqi Airways, Misrair, Middle East Airlines, Cyprus Airways and Turkish Air Lines.

## N.Z. TRAFFIC EXPANSION

RECORD traffic-figures for the financial year ended March 31st are announced by New Zealand National Airways Corporation, whose aircraft carried more than 300,000 passengers during that period. The Corporation also doubled the amount of freight and mail carried during the previous 12 months.

Total number of aircraft movements at New Zealand airports during the 12 months was more than 90,000, of which one third were at Paraparaumu. Harewood came next with just on half Paraparaumu's movements, and Whenuapai was a near third.

## EL AL PROGRESSES

RECENT agreements between the Governments of Israel and those of France, Switzerland and Italy have given additional traffic rights in Rome, Zurich and Paris to El Al (Israel Airlines, Ltd.) The El Al routes affected by the new rights are those between New York and, in addition to the three cities mentioned, Athens.

El Al, which can be translated as "to the heights," is at present operating a fleet of three Constellations, two DC-4s and a number of Curtiss C-46 Commandos. The company began operations in 1949 with a weekly service between Tel Aviv and Paris. Since then its staff has increased from less than 100 to over 750, the majority of whom are young Israelis. Between 1949 and 1951, operational, administrative and technical services were established in Israel and commercial representation was set up in London, Paris, Rome, Zurich, Vienna, New York, Los Angeles and Johannesburg. Expansion of El Al traffic during that period is indicated by the following table :—

| | 1949 | 1950 | 1951 (first half) |
|---|---|---|---|
| Aircraft miles flown ... ... | 152,000 | 11,000,000 | 8,500,000 |
| Passengers carried ... ... | 2,150 | 14,700 | 9,000 |
| Freight carried (short tons) ... | 5 | 250 | 290 |

## GUESTIMATING THE COMET II

CONTINENTAL aviation journals have recently published a considerable amount of Avon-Comet data which, although by no means official, are looked upon as fairly near the mark. Immediately apparent is the beneficial influence of the Rolls-Royce Avons; with a specific fuel consumption considerably below 0.9 lb/lb thrust/hr at full power, they are said to lower the overall fuel consumption of the aircraft from 17.5 lb/mile to 15 or less. As a result, the 28,570 lb of paraffin available for cruising—after deducting for all other requirements—provides a range of 2,070 n.m. with a payload of 12,190 lb. Corresponding Mk 1 figures are given as : range 1,600 n.m. carrying 10,640 lb payload. At the same time, Series II cruising speed is quoted at 435 kt (502 m.p.h.) against the 427 kt of the Ghost-Comet. Even so, there is little doubt that continental observers will one day be working out data for even newer Comets and arriving at still more impressive figures.

## I.C.A.O. BUDGET REDUCED

FOLLOWING the strong calls for economy made by many delegates to the sixth session of the I.C.A.O. Assembly, which ended in Montreal on June 12th, a budget of £1,006,131 for the conduct of the organization's business in 1953 was adopted. Some £6,000 less than the 1952 budget, this cost will be shared by 57 member-nations. The main contributors will be America

*ON SAFARI: Sir Archibald Hope, managing director of Airwork, Ltd., waves off from Blackbushe the first "C-rate" service to Nairobi—the "Safari" service operated jointly by his company and Hunting Air Transport, Ltd., which was inaugurated by both concerns on Saturday, June 14th.*

## CIVIL AVIATION . . .

(27 per cent), the U.K. (9 per cent), France (5.7 per cent), Canada 5 per cent), India (3.5 per cent), and Australia (3.5 per cent).

As the next session of the assembly will be a major one, reviewing I.C.A.O.'s work in the technical, economic and legal fields, it was decided not to hold it in Montreal. The governments of Britain and France have offered to act as hosts at this meeting.

While discussing the question of economy, the assembly turned down a Portuguese proposal that study should be given to the relative merits of Montreal, the present H.Q., and other sites as the permanent I.C.A.O. headquarters. This decision was doubtless influenced by the Canadian offer to reduce by approximately £46,000 the annual rent paid for the Montreal building.

## B.A.I. LUNCHEON

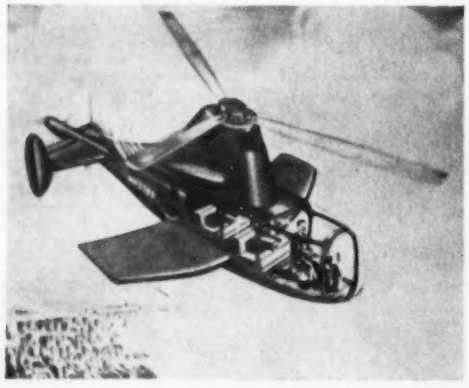
THE annual informal luncheon of the British Aviation Insurance Co., Ltd., was held at Londonderry House last Friday, June 20th. Sir John Makins, the chairman, welcomed guests on behalf of his company's directors and of their underwriter and principal surveyor, Captain A. G. Lamplugh. Mr. Whitney Straight, deputy chairman of B.O.A.C., replied for the guests. Remarking on Sir John Makins' reference to the inauguration of the Comet jet services as the outstanding event of the year, he said that insufficient credit had been given to Lord Knollys and to the directors of B.O.A.C. and B.S.A.A. at the time when Comets were ordered. They had shown great courage and foresight. Now we should be planning to preserve our lead. Times moved as quickly as the Comet.

## ATLANTIC ALL-FREIGHT SERVICES

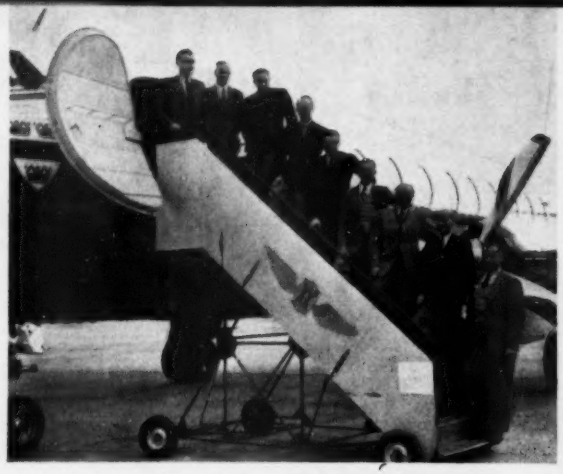
ONE of the leading American freight carriers, Seaboard and Western Airlines, have criticized the Civil Aeronautics Board for its recent refusal to permit the company to operate scheduled freight services between Europe and the Middle East. A petition filed with C.A.B. by the operator states that the Board's action was contrary to the official views of the Department of Defence, which had informed Seaboard in 1950 that it favoured the certification of all-cargo services across the North Atlantic. Seaboard's petition includes some interesting statistics which support their claim that the United States has lost its leadership in international air freight to foreign operators during the past three years.

In 1947, it is stated, American carriers lifted 72.7 per cent of the total freight taken across the North Atlantic; the proportion dropped to 53.7 per cent in 1949 and was further reduced to 36.4 per cent in 1951. Seaboard explain that the use of all-cargo aircraft has been practically abandoned by the American companies on the North Atlantic route. PanAm made only three all-freight crossings in 1951 and T.W.A. made only six, whereas K.L.M. made 178 cargo crossings and S.A.S. 150. The Seaboard petition quotes an extract from the British Government's new civil aviation policy to illustrate the increasing trend towards non-American domination of international cargo traffic: " . . . we have hopes of independent companies developing the all-freight market, which is a growing field of great possibility."

Seaboard and Western Airlines are at present engaged on the military airlift between California and Tokyo and its aircraft have made 1,187 crossings of the Pacific. Since 1947, the company's aircraft have also made 1,407 North Atlantic crossings. Seaboard's present fleet consists of nine DC-4s, which will be supplemented, early in 1954, by five freighter versions of the Super-Constellation.



*PROJECT: Manufacturers of air-cooled engines since 1929, the Jacobs Aircraft Engine Company, of Pottstown, Penn., has now entered the helicopter field with the Model 104 sketched above. Of gyrodyne configuration, this project will be powered by a 350 h.p. Jacobs radial; all-up weight is foreseen as 3,258 lb and cruising speed as about 155 m.p.h.*



*AMBASSADORS BY VISCOUNT: As recounted on page 781, the prototype Vickers-Armstrongs Viscount 700 left Blackbushe on Saturday last for a tour of India, Pakistan and the Middle East. Among the members of the party pictured here on departure, were (reading down the steps): Mr. A. D. McN. Boyd (tour manager); Mr. J. Bray; Mr. D. Jones (navigator/radio-operator); Capt. Wakelin (B.E.A.), 2nd pilot; Mr. S. Sloan (captain); Mr. S. Jones; Mr. E. Walker; Mr. J. Leach; Mr. S. Pickett.*

# BREVITIES

THE civic heads of Hull and Grimsby are to make a joint request to the Minister of Civil Aviation for support for the running of a helicopter service between the two ports. Cross-river communication between Hull and Grimsby has been made increasingly difficult by shoals in the River Humber and by the cancellation of ferry services at low tide.

* * *

*Torkil Viking*, the first of a series of fourteen DC-6Bs ordered by S.A.S., has now been delivered. Seven more will be delivered this year and the remainder will follow in 1953. Carrying seats for 81 passengers, the aircraft will be used on North Atlantic cut-rate services.

* * *

Approximately 1,600 students will be flown between Europe and North America this summer in DC-4s or Stratocruisers chartered by the travel department of the National Union of Students. Altogether 29 flights will be made—by B.O.A.C., K.L.M., Sabena and El Al.

* * *

Six countries (Poland, Czechoslovakia, Bolivia, El Salvador, Guatemala and Jordan) lost their voting powers in I.C.A.O. for non-payment of debts totalling £180,000. Suspension of voting rights does not eliminate access to the I.C.A.O. technical aid programme.

* * *

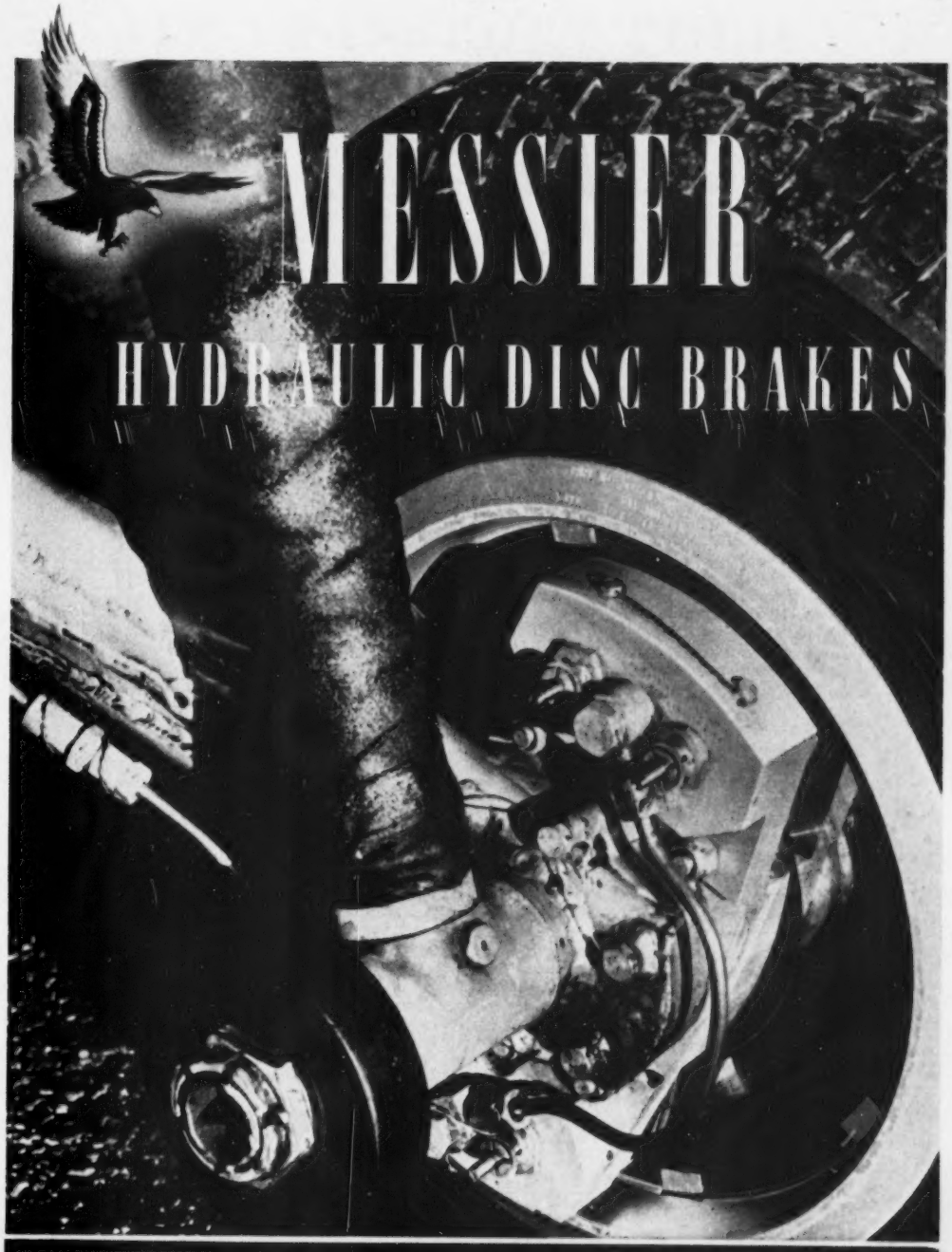
Mr. E. J. Curwood, fleet maintenance engineer of B.O.A.C.'s Stratocruiser and Constellation fleet, has been appointed official-in-charge of the Corporation's base at Filton. He succeeds Capt. D. I. Peacock, who, as manager of the fleet, is moving his office to London Airport.

* * *

During the 1951 season, the A.N.A. Bristol Freighter employed on the Australian Air Beef operations carried a total of over 3,000,000 lb of beef and hides and flew 82,235 miles. Mr. I. H. Grabowsky, planning and development manager of A.N.A., forecasts that the fourth season, which began in May, will prove to be a record one: very dry stock-routes have contributed to the highest-ever bookings, and more and more graziers are recognizing the advantages of exporting their beef by air.

* * *

On week-days, from June 23rd, radar control immediately after take-off is available on a trial basis in the London Control Zone. Initially, the new service will be used to expedite the take-off of aircraft leaving London and Northolt and routed through Chatham. The cover provided is free from permanent echoes and rain interference, and has a range of about 50 miles from London Airport. Further details are given in *M.C.A. Information Circular No. 52/1952.*




The new Messier Hydraulic Disc Brake—flight tested on several types of aircraft, and laboratory tested on British Messier's comprehensive brake testing equipment.

BRITISH MESSIER LTD. GLOUCESTER

INSIDE **BEA** *No. 9 OF A SERIES*

**Timing** B E A's network of routes forms a complex pattern across the many countries of Europe. The services operated on this route pattern are controlled by a closely-knit plan which integrates every flight on every route and ensures that the greatest possible use is made of our aircraft and crews. Timing is a vital factor in such intensive operations. It is influenced by many things; the times at which people want to travel, the length of the sector flown (often much further than the "crow flies" for reasons of Air Traffic Control or because of prohibited military areas), the best cruising power of the aircraft and the prevailing winds. The operating time of the new Elizabethan 'Silver Wing' service between London and Paris even has to be increased slightly so that meals can be comfortably served and cleared away before landing!

**Calculating** Flying times for each route are settled. Then comes the next question: how many passengers do we expect? Will ten flights a day—or two a week be enough? This is when the whole operating picture starts to build up; flights may have to connect with other airlines and train services; and at the busy airports (Northolt handles more than 200 B E A movements alone on peak days) arrivals and departures have to follow each other like clockwork at not less than two-minute intervals.

**Co-ordinating** Work on schedules begins as much as nine months before their actual introduction. In January and July each year, B E A discuss with other airlines the proposed schedules at the I.A.T.A. Timetables Conference in Paris. "We can't take an arrival from Nice at Northolt at 10.12 a.m. —is 10.30 all right? Brussels offers us 3.25 instead of 3.00 p.m. Our afternoon Basle service misses a train by six minutes" —these are some of the puzzles which are thrashed out and solved.

**Operating** "Keep 'em flying" is B E A's aim. Aircraft on the ground earn no revenue, so turn-round times are kept short. And the schedules are fast-moving. For example, an aeroplane may spend three days flying almost continuously. But, at the end of the third day, it still has a few hours left before it is due for overhaul; so the "tail-end" of the period is used for a late evening trip to Paris and back at an excursion fare.

**Improving** When a new aircraft comes into service, many schedules can be speeded up. The Elizabethan has already cut down London-Paris flying time to 80 minutes, and the new turbo-prop Discovery (due to enter service next December) will reduce times for the longer routes by as much as two and three hours. At a time when the air routes are becoming more and more congested, these faster schedules will place greater emphasis than ever on the soundness of our schedules planning. B E A is preparing accordingly.

**BEA**

BRITISH EUROPEAN AIRWAYS

# AIR-TRANSPORT POLICY

## —*is Debated in the House of Lords*

ALTHOUGH doubts and uncertainties still remained on certain points, a clearer appreciation of the Government's intentions with regard to civil aviation is possible in the light of the debate which took place in the House of Lords on June 17th. By comparison with some previous debates, there was a refreshing absence of purely doctrinaire argument, and practically every speaker brought specialized knowledge of one kind or another to bear on the subject (all four Opposition peers who took part were former Ministers of Civil Aviation). Nevertheless, occasionally irrelevant references tended to unbalance the discussions. There follows a condensed account of the debate.

LORD LEATHERS, opening for the Government, said he believed the Government's civil aviation proposals had been well received. At any rate, he added in reply to an interjection from Lord Ogmore, there was very little support for the opposite view. Perhaps the biggest misunderstanding entertained on the Socialist benches, he continued, was that the Government's policy represented a severe, if not a mortal, blow at the Airways Corporations. There was nothing in the Government's recent statement which could be so interpreted; he yielded to no one in his admiration of the work of the Corporations, or his conviction that they had a vital part to play in civil aviation. On the contrary, he rather resented any suggestion that the Labour Party had a proprietary interest in the Corporations' welfare.

Lord Leathers then recalled a speech made by Lord Pakenham in 1950, in which he stressed that the fundamental question was not the relative merits of State *versus* privately controlled airlines, but the form of organization best calculated to secure expansion of our national air transport effort. It seemed to the speaker that Lord Pakenham had attached importance to a strong and prosperous private sector of the industry, and that he had been at pains to emphasise that he did not wholly exclude independent companies from participation in the operation of scheduled services, but that opportunities must be confined to routes outside the existing or planned networks of the Corporations.

The Government's policy, like that of Lord Pakenham, was to adopt a form of organization best calculated to secure the expansion of our national air transport effort. But it was their view that the independent companies could play a more important part in attaining that objective, without undermining the work of the Corporations. The new policy would consolidate the position the Corporations had established and would protect them in the expansion of the first-class and new tourist-class markets on the routes they had developed.

The Government believed that the concentration necessary for these important tasks of expansion left room for other initiative in new development. Experience since the war had shown that exclusive monopoly did not allow enough flexibility.

This drawing on experience was in no sense a criticism of the Corporations. It merely reinforced the wisdom of the Government in providing opportunities for the independent companies to develop without subsidy new routes and specialized forms of operation such as all freight services, third-class services, and non-competitive inclusive tours.

But if we were to reap the benefit of the contribution which the independent companies could make in these directions to the development of air transport, they must have security of tenure of their rights, without being fettered by the long-term plans of the Corporations.

Dealing with internal routes, Lord Leathers explained that the objective was to reduce—and, in the long run, to eliminate—the relatively high cost of these services to the taxpayer. The best means of achieving this, with the maximum advantage to the public, both as taxpayer and consumer, required more examination. For the time being, therefore, B.E.A. would continue their existing services, but independent companies would be able to obtain long-term associate agreements on new routes outside the B.E.A. network. If it could be shown, for example, that an independent company could take over under satisfactory terms a group of routes at present operated by B.E.A. at a loss and run them without subsidy, that was something which would have to be considered very carefully. Special considerations, however, applied to the Scottish social services [more light was cast on this matter later in the debate by Lord De L'isle and Dudley].

An important question—which had been asked in a number of quarters—related to the machinery for giving effect to the Government's proposals. The Government envisaged the continuance of the Associate Agreement scheme introduced by Lord Pakenham in January, 1949. There would, of course, be modifications, but in principle and constitution the new scheme would be similar to the old. The Air Transport Advisory Council would continue its task of considering applications and making recommendations to the Minister. It was not proposed to confer any statutory licensing duties on the Council, which would continue to act in an advisory capacity and to make recommendations to the Minister under Section 12 of the Civil Aviation Act, 1949.

The Council would, however, be asked to make its recommendations in accordance with revised terms of reference which took account of the new policy. No detailed statement could be given on what the changes would be, but the significant points of difference between the new and the old schemes were: First, in the wider scope which it was proposed to give to the independent operators. For example, the Corporations would no longer have the same protection on routes which they had not yet operated; secondly, the normal maximum period of associate agreements would be extended from five to seven years (or ten years in special cases); and thirdly, the Corporations would be put on an equal footing with the independent companies in seeking permission to develop new routes.

Nothing would be done to impair the commercial prospects of the Corporations on the overseas routes they had developed. The new terms of reference would provide that on these routes the financial position of the Corporations should not be materially worsened. These changes would doubtless involve the A.T.A.C. in making certain changes in their procedure, but the resources of the Ministry would be used to obviate duplication of staffs. For example, the Ministry had technical and economic sections who could supply the Council with much of the necessary information required to examine applications.

There was, Lord Leathers stressed, no substance in the comment that the Government proposals would virtually take away from the Minister and from Parliament the control of the development of civil aviation in this country. At the same time, there was no doubt that the experience and advice of the A.T.A.C. would be of immense assistance to the Minister.

It was also emphasized that before the Minister approved an associate agreement between an independent operator and one of the Corporations he would satisfy himself that in the case of routes of public importance the applicant had the necessary financial resources to fulfil his obligations to the public on an enduring basis. The A.T.A.C. would examine whether an applicant would be able to provide a satisfactory service from the point of view of continuity, safety, regularity of operation, frequency, punctuality, reasonableness of charges, and general efficiency. Naturally, it would also take into account the manner in which the applicant had performed any services for which he had previously been authorised.

Possibly the most serious question arising from the policy statement was whether sufficient numbers of suitable aircraft were available to enable independent operators to make the fullest use of the wider opportunities now offered to them. Lord Leathers did not deny that the supply of aircraft suitable for independent operators was not as good as the Government would wish; but he said the Government were examining, in conjunction with the aircraft industry, what measures could be taken to overcome these difficulties.

### Surplus Aircraft

He also mentioned that the Ministry of Civil Aviation had available for disposal small numbers of Tudors, suitable for freight work, and Solent flying-boats. Further, the Air Ministry would have, from time to time, Dakota aircraft available for sale to suitable British operators. In accordance with the new policy for limiting the charter operations of the Corporations, the B.O.A.C. were already offering for sale two of their York freighters. In regard to more modern types, he had been advised that short or medium-range freighter aircraft could be supplied reasonably quickly.

Concluding his address, Lord Leathers said that the prospects for the civil aviation industry seemed to be bright. The Government hoped that the Corporations, whose achievements in the international field were a matter of pride, would continue to go on from strength to strength, and that the independent companies, given more scope and more security, would at last take their place in British civil aviation, developing the services they already flew and having a fair opportunity to enter new fields. The working out of this policy depended, of course, on the industry seizing its opportunities. The Government believed it could, and would.

LORD PAKENHAM (Minister of Civil Aviation, 1948-51), who initiated the debate, opened his speech by congratulating the Corporations on their achievements in recent years. In 1947-48, he said, their deficits had amounted to about £11m. Last year they were just over £1m, with B.O.A.C. showing a profit and the whole residual loss arising on the internal routes of B.E.A., in which, of course, a large element of social service was provided. In that period the output, judged in capacity ton miles, had more than doubled, and the output per employee (for there had been a big reduction in staff) had almost trebled. Lord Pakenham also congratulated the charter companies and expressed his pleasure at the considerable improvement in their fortunes, which did them credit in every way.

Lord Pakenham said he thought it would be paying the statement of the Government an ill-deserved compliment to describe it as a statement of "policy."

The Opposition viewed it with grave suspicion. However wisely it might be interpreted, it could do no good, and it might well do a great deal of harm—in the first place to the Corporations and ultimately to the charter companies themselves. In the end, perhaps more harm might come to the charter companies than to the Corporations.

After reviewing, at some length, the former Government's policy towards the independents, Lord Pakenham said that he did not quarrel with two points in the Government proposals. The first was the extension of the agreements to periods of seven, or in special cases ten, years, and the second was the restrictions on the charter activities of the Corporations (while maintaining their right to engage in charter work where they had special facilities). He did wonder, however, how the Secretary of State was going to satisfy himself that the charter company which obtained a route would be able and willing to operate it, not just at the beginning, but over a long period like seven years. Did the Government intend to impose an obligation of a legal character, and if so, how long would it be enforced?

He also hoped the Secretary of State would be able to say that an assurance given to Lord Ogmore that no change was contemplated in the present relationship between the Minister and the A.T.A.C. was not merely a transitional arrangement, pending legislation. Lord Pakenham then referred to the terms of reference given by the Minister to the A.T.A.C.—clearly the central point of the debate. Above all, there was

## AIR-TRANSPORT POLICY . . .

the cardinal question as to how far the provisions would be maintained, whatever the precise wording of the associate agreements, so that the associate arrangements would not overlap or compete with existing services and planned programmes of the Corporations.

It seemed to him that the Corporations would have to plead their own case before the licensing authority whenever they wanted to start a new route, either passenger or freight. There was one disadvantage of the arrangement already in negotiations between B.O.A.C. and foreign operators, when brought up to Government level; such bilateral agreements were a complicated business. If a "licence" were to be negotiated publicly before such bilateral discussions began, not only would a great deal of time be occupied, but disclosure of the intention would certainly strengthen the hand of the foreigner, rather than that of our own people. That seemed bound to happen anyway if B.O.A.C. and B.E.A. had to come before the licensing authority every time they wanted to start a new route but, for the rest, all was uncertainty of a most damaging and crippling kind—at any rate so long as the system endured.

Referring to the opportunities of opening new routes which had been promised to independents, Lord Pakenham said that several questions immediately arose. What was a new route? Did it involve the inability of the Corporation concerned to vary the sector call-points on an end-to-end route—for example, on the London-Sydney route? Did it mean that the Corporation was bound to its present points of call in Europe on the way to Australia, or could they be varied according to the traffic from time to time?

As regards freight, was it intended that the existing freight services of the Corporations should be cut into, and that the Corporations should be restricted in their search of new freight business? In respect of third-class services, no definition existed of a service of this kind, but he felt bound to conclude that they would drain off some of the traffic from the Corporations. On the Nairobi services, for instance, it was hard to see how this result could be avoided. In short, whatever the directive, the Corporations—and with them the taxpayers—were likely to suffer. But the damage might well be fundamental and lasting unless the A.T.A.C. were given an overriding directive that it was to be their specific task in the future, as it had been hitherto, to see that the prospects of the Corporations were in no way prejudiced.

The Government's statement, said Lord Pakenham, had left the whole future of the internal services completely obscure. No one was sanguine enough to suppose that the internal services as a whole could be run at a profit in the immediate future; the Opposition regarded it as unthinkable that a subsidy should be paid to a profit-making company under conditions of this kind. He pressed the Secretary of State for an assurance on these lines.

Summing up, Lord Pakenham said that the Corporations were called upon to operate their routes day in and day out, in good times and in bad; there could be no comparison between their position and that of a charter company, which naturally wanted to nip in on a particular route that seemed profitable for the moment. If the slogan of equality of opportunity were applied in practice without equality of responsibility, which was what would happen, he could not say who would win. But one person would assuredly lose—the British taxpayer. Whether the new policy meant much or little, he said, it seemed to the Opposition a particularly ill-judged moment to establish a so-called licensing authority, and to cast a cloud over the prospects of the Corporations, just when they were beginning to get their heads above water.

### Reversal of Policy?

LORD BALFOUR thought it incumbent on the Opposition to state what would be their policy if returned to power; if there was to be a reversal by the Socialist Party of the new policy they would be doing a grave disservice to British civil aviation. He thought the Government had made a most admirable compromise between uncontrolled competition on the one hand and absolutely unrestricted monopoly on the other. The Corporations, he believed, had on their plate all they could manage in developing their existing routes to cope with the potential traffic.

All over the world, said Lord Balfour, events were overtaking theory, and the efficacy of artificial restriction of supply in the interests of vested interest had been disproved on more than one occasion. In Australia, the chief internal operator had for years been a private-enterprise line; when a Labour Government was elected there, they did set up a rival State line to which they gave a most lucrative mail contract which the private-enterprise concern had been enjoying for some time past. Yet, in the end, both firms flourished. Their traffic today was four times what it had been when the State line was started.

Lord Balfour added that about a year ago, when certain charter lines were licensed to carry Service families from East Africa to Britain, B.O.A.C. had complained that their traffic would be so hit that they would have to reduce their frequency of regular services to, probably, once a week. In the event, the Corporation took competitive measures. They introduced family concessions, lowered their prices, and found that frequency had increased.

The Government's policy, he felt, seemed certain to give enormous opportunities without damaging the State-owned monopolies. He believed it would result in our getting a reserve in time of war, and would go some way to making up the deficiencies of Transport Command. Lord Balfour felt, however, that there should be a rather better tenure than the seven years proposed; it was doubtful whether this period would be long enough to attract the subscription of capital. He advocated also that priority in construction of the Comet and Viscount should be just as high as that given to combat aircraft.

LORD OGMORE (Minister of Civil Aviation, 1951) obliged Lord Balfour with a statement on Socialist intentions. They would do nothing which would in any way injure the Corporations; they would, in fact, assist them in every way to maintain their positions and increase their business. As to the charter companies, subject to these principles, they would help them in every possible way.

He challenged Lord Balfour's suggestion that there was a pure case of nationalized industry against private enterprise. There was sufficient work, said Lord Ogmore, for both nationalized industries and private companies without their coming in conflict. The Opposition fear was that the Government's policy, without really benefiting the chartered companies, might seriously affect the nationalized Corporations.

The country was deriving tremendous prestige from the Comet—not only because the great firm of de Havilland's, or from A. Cdre. Whittle, but also from B.O.A.C., who were the only corporation in the world prepared to take the risk of ordering 14 Comets. Lord Ogmore urged the Government to show like courage. He suggested that contractual assistance should be given to further development of the "Mk III jet" [presumably a reference to a "stretched" Comet]. Similar assistance should be given, if necessary, to the manufacturers of the medium-range turboprop liners.

The MARQUESS OF WILLINGDON brought an immediate reaction from Lord Pakenham when he suggested that future traffic could be split up in the ratio of 80 per cent for the Corporations and 20 per cent for private enterprise. He hastened to add that that was only his personal idea. There was, he felt, a case for a "buying agency" to acquire all the best transport aircraft for the R.A.F., the corporations and the private companies. Otherwise, seven years' tenure would be a business proposition, bearing in mind today's high operating costs.

LORD NATHAN (Minister of Civil Aviation, 1946-8) also felt that the terms offered to charter companies might not be sufficiently attractive. Suitable aircraft could only be obtained, he said, by an acceleration in production or by diversion of orders already given to the Corporations. But the Corporations were entitled to know where they stood, because it was they who had ordered these aircraft. Were the independent operators to come in and have all the advantages of the development work done by the Corporations at the taxpayers' expense? Or were they themselves to make some—and if so what—contribution to those development charges? And how were the operators to get their trained crews and their pilots for the scheduled services—was that to be done at the expense of the Corporations? What was to be the position, with regard to pensions, of Corporation employees if they became redundant and had to join an independent company?

LORD NATHAN concluded that from the purely practical point of view of the administrator, of those concerned in the industry, and of the taxpayers, the Government policy had not really been thought out.

### Prestwick Suggestion

LORD CLYDESMUIR was confident that there would arise in Scotland a strong charter company able to play its part in the link services. Mentioning his disappointment with progress in the improvement of Prestwick, he suggested that the United States, who had a great interest in this terminal, might be ready to help with the cost.

LORD WINSTER (Minister of Civil Aviation, 1945-6) said the Government's policy had not filled him with particular alarm or suspicion. He did not feel that it really embodied tremendous concessions to the charter companies, who themselves had been inclined, if anything, to look this gift horse in the mouth.

Nationalization, he felt, would neither succeed nor fail 100 per cent. As a system it could not represent finality. He believed that it would merge into and contribute to some other system such as, for instance, the State owning the assets and leasing them to an operator.

LORD SEMPILL said he was shocked that no reference had been made to flying-boats in the debate; he declared that air transport must, for technical and practical reasons, be ever more concerned with the flying-boat. He intimated that he would raise the question again in a future debate.

LORD DE L'ISLE AND DUDLEY, in replying to the debate, told Lord Pakenham that there was to be no subsidy for charter companies on internal routes, except possibly in the case of Scotland. Lord Pakenham commented that this was a sensational and novel statement bearing no relationship to anything that had reached his hearing. Lord De L'Isle further explained that the Government did not rule out a Scottish subsidy, as they had in the case of other British internal services, but he did not want to be misunderstood in saying that a subsidy to the Scottish services was under consideration.

Lord De L'Isle took the view that the debate had shown that, despite Lord Pakenham's protestations, no very wide difference had existed, at any rate in principle. Where the two parties might be said to differ was in the exclusive emphasis which Lord Pakenham placed on the Corporations. He affirmed that it was not the intention of the Government to harm the Corporations.

The aim was to get more traffic for the whole of British civil aviation. He thought the nature of that policy had been largely misunderstood. Firstly, it had to be emphasised that the Minister was to have the last word and the A.T.A.C. would not become a licensing authority. The only change—admittedly an important one—was that the Corporations could not claim a prescriptive right as to future routes.

A large charter fleet, said Lord De L'Isle, would be an immense asset in time of war, not only to the Air Force, but to the Army. He did not think they had so far got the kind of aeroplane they ought to have, which he might call a modern Dakota, which was a useful, workable aeroplane, strong and capable of flying in difficult conditions. That was the sort of aircraft which would be an immense national asset, because it would be available to the Corporations, to the charter companies, to the Royal Air Force, and for export.

He assured the House that he was in constant consultation on the subject of civil production with the Minister of Supply. They had already made way in one instance for a very important commercial aircraft. They saw that it would be absolutely wrong to insist on laying down a military line for a certain type, when the particular type of civil aircraft was so vitally important.

Lord De L'Isle summed up by saying that civil aviation had become, or was becoming, what sea power used to be, and it was the Government's desire to see that Great Britain had in this important and expanding field a share which was large, because that was our due.

# SERVICE AVIATION

*Royal Air Force and Naval Aviation News*

## Exercise "Castanets"

FROM Wednesday, June 18th, until yesterday, over 150 warships and 400 aircraft have been engaged in extensive naval/air exercises under the code name "Castanets."

The exercise has been of wide scope, with over 100 fleet auxiliaries operating as merchant ships in convoy or sailing independently. The complete NATO defence organization was in operation under the general direction of the Allied Commander-in-Chief, Channel, Admiral of the Fleet Sir Arthur Power, whose headquarters were at Fort Southwick, near Portsmouth. The air side was in the hands of Air Marshal Sir Alick Stevens, operating from Coastal Command headquarters.

Under these two commanders, area control was exercised as follows: The Nore, Admiral Sir Cecil Harcourt and A. Cdre. W. H. Hutton; Plymouth, Vice-Admiral Sir Maurice Mansergh and A.V-M. T. C. Traill; Rosyth, Rear-Admiral J. H. F. Crombie and A.V-M. H. T. Lydford; Walcheren, Rear-Admiral C. W. Slot, R.N.N.; Cherbourg, Rear-Admiral G. R. J. Rebuffel, French Navy; and Brest, Vice-Admiral A. R. M. Robert, French Navy.

On the attacking side, the submarines were controlled by Rear-Admiral C. W. G. Simpson and their supporting reconnaissance aircraft by G/C. F. A. Pearce—both working at Londonderry. Defending fighters were operated by their own national air force commanders.

The highlight of the first day of the exercise was the chase of the fast minelayer *Apollo*, which was representing an enemy raiding cruiser returning from operations in the Atlantic. She was found by Shackletons of Coastal Command about 150 miles east of Dundee at 1940 hr the same day. A striking-force consisting, with other ships, of the *Vanguard*, the Dutch aircraft carrier *Karel Doorman* and the *Swiftsure* sailed from Rosyth to head off the raider. By the time the surface ships were close enough to contact *Apollo*, fog patches developed, which were sufficiently dense to prevent the *Karel Doorman* flying-off her strike aircraft. The raider succeeded in returning to her Cuxhaven base.

During the first day, also, several coastal and ocean convoys were attacked by submarines and aircraft. One submarine attack on an East Coast convoy was considered to be successful and the same convoy was twice the target for aircraft operating from *Illustrious*, which was taking part as an enemy air base. Avengers flying from the Canadian carrier *Magnificent* attacked a submarine, while Shackletons from St. Eval located two and claimed one submarine sunk.

An interesting sidelight was the location of a submarine at periscope depth in the Firth of Forth by a helicopter from No. 18 Group. Surface forces called up by the helicopter claimed the submarine as sunk. Bomber Command Lincolns, on behalf of the Red forces, mined the Thames estuary.

On the second day the *Karel Doorman* appeared to have a bad time. In an attack by "enemy" Sea Furies and Fireflies from the *Illustrious* she was unable to fly-off any aircraft and her flight deck was adjudged to be out of action and her speed reduced. She was then torpedoed by the submarine *Sirdar*, which had broken through the protecting destroyer-screen.

Some of the operations at this period were hampered by bad weather, but aerial minelaying continued. Nine convoys safely made port but a successful attack was claimed by a submarine against a merchantman in the Cherbourg area. Coastal Command continued active: four sightings and two sinkings were claimed and in one of these attacks a Shackleton was itself attacked by Red aircraft.

On the third day *Apollo* came out from Cuxhaven again but was soon located from the air by a Dutch naval aircraft operating from Portland. A Shackleton then took over the job of shadowing the raider until surface craft arrived to attack. In the ensuing battle *Apollo*'s speed was considered to have been reduced from 25 to 10 kt.

Widespread air operations continued. Lincolns planted more mines and minesweepers operating off Le Havre were attacked by U.S.A.F. jets. A troop-carrying convoy in the Channel was heavily attacked by naval aircraft operating from Cornish airfields, but defence by jets of Fighter Command prevented any recurrence of the attack. Sunderlands of the French navy, as well as Coastal Command and R.C.A.F. aircraft, made a number of submarine sightings.

Interspersed in all this aerial activity were attacks by coastal motor-boats, frogmen and midget submarines, which emphasized the insecurity of any ship, naval or merchant, in time of war.

The final phases of "Castanets" will be dealt with in our next issue.

*FLOWN ABOARD: Seen with (left) Vice-Admiral C. E. Lambe, C.B., C.V.O., Flag Officer Air (Home), and (right) the captain of H.M.S. "Eagle," Capt. Guy Willoughby, are Lord De L'Isle and Dudley, V.C. (Secretary of State for Air); the Rt. Hon. J. P. L. Thomas, M.P. (First Lord of the Admiralty); and the Rt. Hon. Duncan Sandys, M.P. (Minister of Supply). The three visitors were flown aboard the new carrier as she steamed in the Moray Firth area.*

### Senior Appointment

IT has been announced that Air Marshal Sir Francis J. Fogarty, K.B.E., C.B., D.F.C., A.F.C., will become Air Member for Personnel on November 1st next, in place of Air Chief Marshal Sir Leslie N. Hollinghurst, G.B.E., K.C.B., D.F.C., who is retiring after three years in this post.

Sir Francis joined the ranks of the Royal Flying Corps early in 1917, receiving his commission some four months later. At the outbreak of the second world war in 1939 he was a wing commander in command of No. 37 (Bomber) Squadron. After a variety of appointments he became S.A.S.O. to No. 4 Group Bomber Command and at the end of hostilities was A.O.A. at H.Q., M.A.A.F.

Until recently he was A.O.C.-in-C., Far East Air Forces, a post he had held since November, 1949.

### R.C.A.F. Ground Defence

AT Camp Borden this month the Royal Canadian Air Force is opening a ground defence school. F/L. B. P. Coote, who will be in command, is loaned by the R.A.F. Regiment in the United Kingdom.

### R.A.F. Appointments

THE Air Ministry has announced that A.V-M. L. J. V. Bates, C.B., C.B.E., who since May 1949 has been A.O.C. No. 40 Group, Maintenance Command, is to be Director-General of Equipment from September 1st next.

The new A.O.C. No. 40 Group will be A.V-M. Jackman, who has been Director of Organization (Forecasting and Planning) for the past three years.

After having spent a year as Senior Admin. Officer at H.Q. Transport Command, G/C. R. C. Jonas is to become Director of Intelligence with the acting rank of Air Commodore. He will take up his new appointment in August.

## SERVICE AVIATION . . .

### R.O.C. Summer Camps

ON Monday last, 450 men and 150 women observers from 39 groups of the Royal Observer Corps were due to meet at R.A.F. Waterbeach, in Cambridgeshire, for the first of five consecutive 7-day camps.

### S.A.A.F. in Korea

THE little-publicised No. 2 Squadron, South African Air Force, recently completed 8,000 sorties in Korea. Pilot casualties in the unit now number 36 killed, missing or prisoners-of-war. Fifty-five aircraft have been lost.

### North Weald History

ANYONE who possesses photographs, or has knowledge of interesting items of information concerning R.A.F. Station North Weald, or units which have served there, is invited to communicate with the station adjutant. The intention is that all collected matter and illustrations shall be made up in the form of a scrapbook.

### Weather Beaten

THE winner of the Duncan Trophy for 1952 is No. 74 Sqn., with Nos. 1, 56 and 63 as joint runners-up.

The Duncan Trophy does not, as might be thought, come from Scotland. It is, in fact, a two-handled silver cup presented to the Royal Air Force by Gen. Gervasi Duncan, C.A.S. of the Brazilian Air Force, to commemorate his visit to the R.A.F. in 1947. It is at present awarded to the day fighter squadron achieving the best all-weather flying record. In future, however, it is to be competed for by squadrons of the 2nd T.A.F. for efficiency in weapon training. Under this new arrangement there will be three gunnery contests for R.A.F. fighters in Europe: the Dacre Trophy for Regular squadrons of Fighter Command, the Cooper Trophy for R.Aux.A.F. squadrons of Fighter Command and the Duncan Trophy for fighter bomber squadrons of 2nd T.A.F.

No. 74 Sqn. is commanded by Major G. W. Milholland, U.S.A.F.

*BY JET TO STOCKHOLM: Air Chief Marshal Sir Ralph Cochrane with General Nordenskiöld, chief of the Swedish air force, at Barkaby airfield near Stockholm. Sir Ralph had travelled in an English Electric Canberra to make a good-will visit to Scandinavia.*

*S/L. J. A. Kinnimont, D.F.C. and Bar, who has been appointed to command Australia's No. 77 Squadron in Korea. He won his D.F.C. in 1942 while flying Brewster Buffalo fighters against the Japs in Malaya.*

### Cranwell Memorial Chapel

ON Sunday last the new memorial chapel at R.A.F. College, Cranwell, was dedicated by the Bishop of Lincoln, assisted by the Reverend Canon L. Wright, Chaplain-in-Chief, R.A.F.

The chapel is to perpetuate the names of 477 cadets of the College who subsequently lost their lives in the last war. It is within the College building, on the second floor of the west wing, and is panelled in fumed oak, with carved pews of the same wood. The Roll of Honour is contained in a glass-topped case in an alcove at the end of the chapel farthest from the altar.

Each operational command of the R.A.F. has given a pew, each having at its head the command crest. The sanctuary carpet, a rare example of Isfahan weaving, has been presented by the Royal Pakistan Air Force, while the specially constructed sanctuary floor has been given by the officers and cadets of the College. Many donations towards the furnishing of the chapel have been received from relatives of those who lost their lives, and among other donations received are those from the Royal Navy, the Royal Lincolnshire Regiment, the United States Air Force and the Hawker Siddeley Group.

*IN MEMORIAM: Princess Astrid of Norway unveiling, at North Weald, a memorial erected to the memory of Norwegians who died while fighting in the air over Britain. The monument, by Roar Carlsen, bears the inscription "A gift from Norwegians of Nos. 331 and 332 Squadrons, in gratitude for the hope and opportunities so kindly given at a difficult time." Behind Princess Astrid is Marshal of the Royal Air Force Sir John Slessor.*

### Benevolent Fund Expenditure

THE R.A.F. Benevolent Fund spent £169,911 on all forms of assistance to serving and ex-Service personnel during the first three months of the year, an increase of £13,517 on the figure for the corresponding period of 1951. The number of cases helped totalled 6,497.

In England 5,146 cases accounted for £147,477; 454 Scottish cases shared £6,593; there were 313 Welsh cases, who received a total of £7,370; in Northern Ireland 115 cases accounted for £1,016; and 396 cases in the Republic of Ireland shared £3,445.

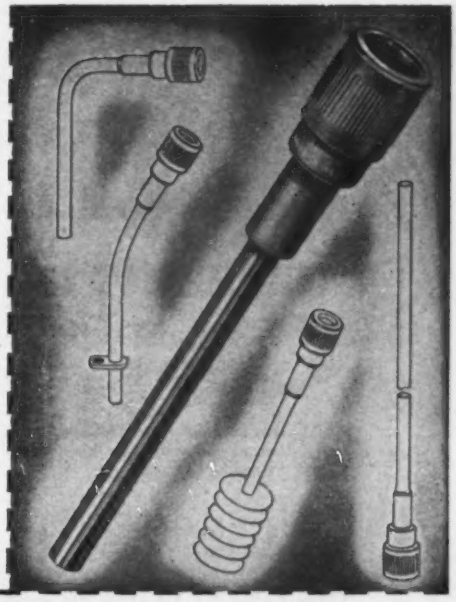
Speaking recently, A.V-M. Sir John Cordingley, controller of the Fund, said: "I should like to emphasise that during the whole of 1951 the total amount received in donations and subscriptions from the general public and from members of the Royal Air Force was £249,622. Although this was an increase of more than £50,000 on the amounts received in 1950, it is a fact that public support still covers less than half our annual expenditure. For the rest the Fund must rely on income from investments and capital and, sad to say, the gap between income and expenditure continues to widen."

### Squadron Tie

MEMBERS of No. 67 Squadron, both past and present, can obtain squadron ties on application to the Adjutant, No. 67 Squadron, c/o Information Division, Air Ministry, Whitehall, London, S.W.1.

# *Weston Resistance Bulbs*

The Model S.110 Platinum Resistance Bulb, used in conjunction with a Weston circular scale indicator is greatly superior in every respect to other methods of temperature measurement. Its platinum element is the most stable, accurate and the smallest yet produced for practical applications. Due to the very small size of the resistance element, the response time is extremely rapid. Reliability and long life are ensured by the fact that the element is hermetically sealed into a ¼" o/dia. stainless steel sheath which is fitted with a watertight plug connection. The socket is moulded integrally with special cable which is supplied. The Model S.110 is suitable for temperatures between −200°C. and +500°C. Full details of Weston equipment for aircraft will gladly be supplied on request.



WESTON
AIRCRAFT INSTRUMENTS

SANGAMO WESTON LIMITED
ENFIELD MIDDLESEX
*Tel: Enfield 3434 (6 lines) 1342 (4 lines) Grams: Sunwest, Enfield*

*Scottish Factory: Port Glasgow, Renfrewshire*

*Branches, Glasgow, Manchester, Newcastle-on-Tyne, Leeds, Liverpool, Wolverhampton, Nottingham, Bristol, Southampton, Brighton*

## *Prices reduced by as much as £50 per van on the famous* WILLERBY RANGE

These astonishing reductions made possible only by modern factory production methods and ever-increasing public demand.

WRITE FOR OUR BROCHURE

★ Willerby Junior Mark I. Was £290 **NOW £260**
★ Willerby Junior Mark II. Was £295 **NOW £265**
★ Willerby Standard 4-berth Was £349 **NOW £299.10**
★ Willerby Junior Home, 18ft. Was £450 **NOW £425**
★ Willerby Standard Home, 22ft. Was £499.10 **NOW £450**
★ Willerby Vanesse Home. Was £549 **NOW £499.10**

MONTROSE Caravan Distributors Ltd
*World Concessionaires for Willerby Caravan Co*

STOCKPORT ROAD, CHEADLE, CHESHIRE, GAT. 6179 & 5866
CITY SITE: TONMAN STREET, MANCHESTER, DEA. 8027

Open 7 days a week 9 a.m. to 9 p.m. Also at Harwood Bar, Gt. Harwood, Nr. Blackburn, Lancs.

IF IT'S CARAVANS—IT'S MONTROSE

## *Have you got the right connections?*

Even the best-designed fuel-run can hold up refuelling operations if the method of connecting one pipe to another causes restrictions. The F. R. Pipe Connector, although designed specifically for pressure-refuelling systems, has proved itself the ideal connector for use in fuel systems generally.

★ Note the following advantages of the

## F. R. PIPE CONNECTOR

A degree of flexibility both axially and radially.
No captive end fittings.
Low weight and compactness.
No special pipe end fittings.

No restrictions to flow.
Wide temperature range (70° to −70° C).
Easy connections in confined spaces
Large range of sizes, from ¼" to 4"

FR
*Pressure refuelling equipment*
FLIGHT REFUELLING LTD
ENGLAND

*If you are having trouble with your connections, write to us:*

FLIGHT REFUELLING LIMITED
Tarrant Rushton Airfield · Blandford · England. Tel: Blandford 501

Jubilee

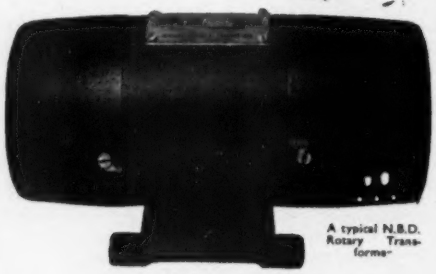
EITHER IT IS
— or it isn't!

JUBILEE has been our registered trade name for 30 years, and may not be used to describe any other clip.

THE FINEST CLIP in the world

L. ROBINSON & CO., (GILLINGHAM) LTD., London Chambers GILLINGHAM KENT PHONE 5287
L.32625

NEWTON-DERBY



A typical N.B.D. Rotary Transformer

Manufacturers of:

ROTARY TRANSFORMERS
AIRCRAFT GENERATORS
and AUTOMATIC CARBON PILE VOLTAGE REGULATORS

ELECTRICAL PLANT SPECIALISTS

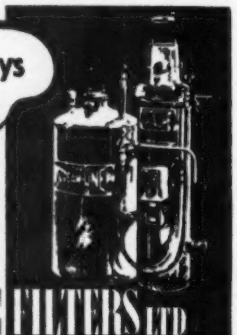
NEWTON BROTHERS (DERBY) LIMITED

Try BUTTERFLY BRAND REGD. for your next ORDER or CONTRACT for MASKING TAPES CLOTH or PAPER

Reliable Quality STOCK SERVICE

SAMUEL JONES & CO. LTD.
NEW BRIDGE ST. LONDON, E.C.4. TEL: CENTRAL 6500

THIS FILTER pays a dividend



30,000 satisfied users of Stream-Line Filters have proved that the regular cleaning of oil improves engine performance and reduces the frequency and cost of overhauls.
In the saving of oil alone, the filter pays for itself in a few months.

STREAM-LINE FILTERS LTD

BELL-SHAW WORKS, INGATE PLACE, LONDON, S.W.8. TEL: MACAULAY 1011

Suppliers of machined and fabricated components in Tufnol, Bakelite and similar materials to Britain's aircraft industry

Telephone: CLERKENWELL 2333/4 & 7247

UHLHORN BROS. LIMITED ESTD. 1887

Telegrams: UHLHORN, AVE, LONDON

We are proud to have the pleasure of supplying our precision products to many of the leading British aircraft constructors

UHLHORN BROS. LTD.
53 CITY ROAD, LONDON, E.C.1

# RUMBOLD'S
## *encompass*
## THE GLOBE

SEATS SUPPLIED TO THE WORLD'S LEADING AIRLINES
SPECIALISTS IN AIRCRAFT UPHOLSTERING

A.R.B. DESIGN APPROVED

PERCIVAL AIRCRAFT LTD.
SILVER CITY AIRWAYS
ICELANDIC AIRWAYS
HANDLEY PAGE, LTD.
ADEN AIRWAYS
• AER LINGUS •
AIRWORK • B.O.A.C.
W.A.A.C. • K.L.M. • B.E.A.C.
C.A.A. • ETC., ETC.

●

**L. A. RUMBOLD & CO. LTD.**
**KILBURN, LONDON, N.W.6**
Tel.: MAlda Vale 7366-7-8



# AVIATION TRADERS LIMITED

*A SELECTION OF STOCK FROM OUR A.R.B. APPROVED BONDED STORES*

**INSTRUMENTS and NAVIGATIONAL EQUIPMENT**

6A/676—Clock, aircraft.
6A/745—Compass, magnetic, P4.
6A/1174—Compass, Astro, Mk II.
6A/1553—Compass, D.R. Master Unit.
14A/3208 and 2206—Camera Control, Type 35.
AN5752-2—Indicator Compass, Fluxgate.
AN5735-1—Indicator, direction.
6B/47—Douglas Protractors.
6B/276—Dalton Computors.

A large quantity of Parallel Rules, Boxwood, 12in and 18in, available from stock.

**ELECTRICAL SPARES AND EQUIPMENT**

5C/758—Fuse Box, Type C.
5C/761—Fuse Box, Type D.

We have large stocks of Aldis Signalling Lamps, Type B, Ref. 5A/2334, with glasses green 5A/2336, and red 5A/2337, as new, complete in transit case.

A large selection of American Cannon and Amphenol Plugs and sockets available. Your inquiries welcomed.

*We invite inquiries for quantity overhaul of aircraft and ground electrical apparatus, and the manufacture of component parts. Our electrical workshops are fully A.R.B. and A.I.S. approved, and equipped for this purpose.*

**MISCELLANEOUS**

We have a quantity of Type B3 Vacuum Pumps available. Your inquiries are invited.

*All inquiries for any of the above items, or items which are not shown, to our Sales Department at :*

**15 GT. CUMBERLAND PLACE**
**LONDON, W.1**

*Telephone :* Ambassador 2091 (5 lines).
*Telegrams :* "Aviatrade, Wesdo, London."
*Cables :* "Aviatrade, London."

FLIGHT and AIRCRAFT ENGINEER

PRESS DAY — *Classified advertisement "copy" should reach Head Office by* FIRST POST THURSDAY *for publication in the following week's issue subject to space being available.*

# CLASSIFIED ADVERTISEMENTS

**Advertisement Rates.** 4/- per line, minimum 8/, average line contains 6-7 words. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Put-ills Announcements. Tenders 5/- per line, minimum 10/- Each paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

**Postal Orders** and cheques sent in payment for advertisements should be made payable to Iliffe & Sons, Ltd., and crossed & Co.

**Trade Advertisers** who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

**Box Numbers.** For the convenience of private advertisers Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street, London, S.E.1.

**The Publishers** retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

**Situations Vacant.** The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service etc. if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.


IMMEDIATE DELIVERY!

AIRWORK LIMITED

HAS BEEN GRANTED

EXCLUSIVE RIGHTS OF SALE

FOR

THREE

USED

'DOVES'

WHICH ARE NOW AVAILABLE FOR IMMEDIATE DELIVERY

*Particulars and Prices from*

THE SALES DIVISION

**AIRWORK LIMITED**

15 CHESTERFIELD STREET

LONDON, W.1

WOLVERHAMPTON AVIATION LTD.

THE LEADING LIGHT AIRCRAFT ENGINEERS. THE AIRPORT WOLVERHAMPTON

*tel.* FORDHOUSES 2228


## AIRCRAFT FOR SALE

W. S. SHACKLETON, Ltd., have been instructed to ask for offers on a number of LB.30 Liberators with spare parts. These machines were specially built as transports.

W. S. SHACKLETON, Ltd., are pleased to announce that with 1952 not yet six months old they have sold 23 absolutely different types of aircraft—many of them in considerable numbers. Here they are:—

DE HAVILLAND TYPES
1. TIGER MOTH
2. MOTH MINOR
3. HORNET MOTH
4. RAPIDE
5. DOVE

MILES AIRCRAFT TYPES
6. AEROVAN
7. MESSENGER
8. MAGISTER
9. MERCURY
10. GEMINI

AUSTER AIRCRAFT TYPES
11. AUTOCRAT
12. AUSTER V
13. AIGLET
14. AUTOCAR

MISCELLANEOUS TYPES
15. PIPER CUB
16. BEECHCRAFT TRAVELLER
17. CHRISLEA SKYJEEP
18. HILLSON PRAGA
19. LOCKHEED LODESTAR
20. AVRO ANSON
21. FAIRCHILD ARGUS
22. AIRSPEED CONSUL
23. S.A. SWALLOW
24. PERCIVAL PROCTOR I
25. PERCIVAL PROCTOR V

W. S. SHACKLETON, Ltd., have in stock several Rapides, Autocrats, Tiger Moths and Messengers. Also a very nice Miles M.28 Mercury, a Taylorcraft Plus D, a Gemini, and Proctors of various sorts.

W. S. SHACKLETON, Ltd., 175, Piccadilly, London, W.1. Tel.: Regent 2448/9. Overseas cables: "Shackbud, London." [0070

FIELD AIRCRAFT SERVICES, LTD.,
offer
COMPREHENSIVE AIRCRAFT SERVICE.
Please send your inquiries to:
FIELD AIRCRAFT SERVICES, LTD.,
CROYDON AIRPORT, SURREY.
Phone: Croydon 7777. Cables: FIELDAIR, Croydon. [0256

MELBA AIRWAYS, LTD.
(IN VOLUNTARY LIQUIDATION)
THE liquidator invites offers for either or both of two DH89A Rapide aircraft and certain surplus equipment. Full particulars may be obtained on application to J. Wild and Co., Incorporated Accountants, 74, Blackburn Street, Radcliffe, Lancashire. [8311

AEROSERVICES (London), Ltd.
OFFER a variety of aircraft, engines and spare parts.
WRITE, telephone or cable:—
46, HERTFORD STREET, Park Lane, London, W.1.
TELEPHONE: Grosvenor 8383.
CABLES: AEROPAUL, London. [0940

R.
K.
DUNDAS, Ltd.
AEROPLANES.

AEROPLANES.
TO the utmost satisfaction of our many clients, we ship or flight deliver aircraft all over the world—and have done so for years. Likewise equipment and spares—in fact everything of an aeronautical flavour is right in our line.

R.
K.
DUNDAS, Ltd., 29, Bury Street, London, S.W.1.
WHI. 2948. Cables: Dundassero, Piccy, London.

CROYDON AIRPORT. CR. 0408. [0559

AUSTER AUTOCRAT. Cirrus Minor, 450 since new. Blue gloss finish. Fitted gyro. 12 months' C. of A. £550.—Perren, Croydon Airport. Croydon 7499. [8322

*An exceptional value offer of*

**ANTI-GLARE SPECTACLES**

Eliminate eye-strain. Invaluable to Motorist, Aviator, Angler and for all outdoor pastimes. Brand new. Modern design. Heavily nickelled frame fitted with optically ground tinted lenses. Note our exceptionally low price. Without case. **17/6**
Complete with case, 21/-.

**GOSPORT TUBES.** Designed for R.A.F. pattern flying helmets. In stock. **18/-** Per pair

*Terms to Flying Clubs. Trade Supplied.*
*Send 3d. in stamps for illustrated catalogue.*

**D. LEWIS LTD. (Dept. F)**
**Leather Clothing Manufacturers for Home or Export**
**124 GT. PORTLAND ST., LONDON, W.1**
*Tel.:* Museum 4314. *Grams: Aviskit, Wesdo, London*

**DAKOTA SPARES**
**Undercarriages**—all parts available
**Wheels** complete.
**Exhaust Collector Rings** complete.
**Exhaust Tail Pipes, Brake Drums.**
All for immediate delivery ex stock.

*Staravia*
**BLACKBUSHE AIRPORT**
**CAMBERLEY, SURREY**
Tel.: Camberley 1800

**FLYING TRAINING**
TO
**HIGHEST MODERN STANDARDS**
FOR
**Private and Commercial Pilot's Licences**
**Instructors' Rating**
TIGER MOTH & AUSTER £3 per hour
NIGHT FLYING - - - £4 per hour
**Contract Rates on Application**
*Ministry of Civil Aviation Approval*
**MARSHALL FLYING SERVICES LTD.**
**THE AERODROME, CAMBRIDGE**
*Tel.: CAMBRIDGE 56291*

### AIRCRAFT FOR SALE

WOLVERHAMPTON AVIATION, Ltd., Tel.: Fordhouses 2191.

CAN offer one more Gemini Mk 3A. Aircraft fitted with Gipsy Major 10 engines, M.R.80 radio, full blind-flying panel, metal propellers. Colour to purchaser's requirements. Delivery three months from order. Price £4,000. [8330]

VENDAIR, for all aeronautical inquiries.—127, Aldersgate Street, London, E.C.1. Tel.: Cle. 2567 [0701]

TAYLORCRAFT C, excellent condition; engine first class; new tyres; resprayed; C. of A. just renewed; most economical. £265 or exchange for car.—78, Winchester Road, Andover. [8342]

MILES GEMINI; airframe and engine hours low; 12 months C. of A.; 8-channel Pioneer; interior grey leather; full equipment. Immediate delivery. Offers, or exchange for Rapide/Magister.—Box 8048. [0800]

MILES GEMINI; aircraft and engine hours 500 since new; 12 months C. of A.; interior grey leather; full equipment. Immediate delivery. Offers, or exchange for Maeister/Rapide.—Box 8050. [0801]

MESSENGER. Full four-seater; airframe 440 hours; engine, Gipsy Major 1D, 270 hours; blind panel; colour, duo blue; C. of A. by Percivals until December 1952. I have just returned from a trouble-free tour of France, Switzerland, Italy and Sicily. Accept £950. Would consider light aircraft or car in exchange.—Turner, 9, Berkeley Court, Avenue Road, London, N.14. Tel.: Palmers Green 7838. [0020]

### AIRCRAFT WANTED

MILES MAGISTER with long term C.of A. and engine hours.—Box 8052. [0803]

RAPIDE with long term C. of A. and engine hours multi-channel V.H.F.; S.B.A. and/or radio compass.—Box 8062. [0802]

PROCTOR IV aircraft required—without C. of A.—which would be suitable for breakdown and spares recovery. Or alternatively, Proctor IV components required.—Please send full details to Box 8056. [7638]

THREE de Havilland Doves. State orig. del. dates, frame and engine hours, sites, and prices.—Automobile and Aircraft Services, Ltd., 49, Brook Street, W.1. Tel.: Mayfair 2747. [8321]

### AIRCRAFT ACCESSORIES AND ENGINES

PESCO feathering pumps c/w motors, guaranteed new, for DC3s and DC4s; also Rotax starters, type C1201.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [7263]

### AIRCRAFT SERVICING

BROOKLANDS AVIATION, Ltd., Brooklands Aerodrome, Weybridge. C. of A. overhauls, modifications and conversions. Tel.: Byfleet 498. [0305]

REPAIRS and C. of A. overhaul for all types of aircraft. A Brooklands Aviation, Ltd., Civil Repair Service, Sywell Aerodrome, Northampton. Tel.: Moulton 3318. [0267]

### CAPACITY AVAILABLE

CAPACITY available for a limited amount of all classes of machining and assembly also for heat treatment and light press work. Own tool making.—Box 0797. [8273]

### CARAVANS

A CARAVAN "Jungle Drum."

YES, the "grapevine" has actually increased (in these times of a general fall in caravan sales) the sales of U.K.'s largest distributor. Why? Because the well-treated customers whisper: "There are many more vans to see than anywhere else, and he gives the only unconditional year's guarantee with a free van loaned for a leaky one and all repairs free one year. Also, the Caravan Residents' Association to help in the site question. We have proved by our own experience that what he says is true." Good h.p. terms and part exchanges. So why not write for 1 lb. of free brochures and advice articles to Dept. F., Taplow, please.—A. S. Jenkinson, Ltd. (our usual selection—London Branch), 90, Oxford Street (corner of Rathbone Place), W.1. Tel.: Langham 5600/7. Two minutes from Tottenham Court Road Tube Station. Open till 8 p.m. seven days a week. Bath Road, Taplow, Bucks. Tel.: Maidenhead 3434/5/6. Always open. Easy to reach—right on Main A4. Outskirts Maidenhead. Taplow Station, 4 minutes. Now open, Hammersmith Branch, corner of Sussex Place and Hammersmith Bridge Road, W.6. One minute Hammersmith Broadway. [0599]

NEW "Statesman." £1,065. Other Berkeleys from £369/10/-. New Glider 4-berth de luxe, £399/10/-, and 2-berth, £212. Safari, £368. Towing. Hire purchase.—Mantles Garages, Ltd., Biggleswade. Tel. 2113. [0307]

### CLOTHING

R.A.F. and R.N. officers' uniforms purchased; large selection of R.A.F. officers' kit for sale, new and reconditioned.—Fisher's Service Outfitters, 85-86, Wellington St., Woolwich. Tel.: Woolwich 1055. [0997]

### CLUBS

REDHILL FLYING CLUB.

LEARN to fly at Redhill Aerodrome, Surrey. South London's nearest flying centre. 23 miles from Hyde Park Corner. £3/10/- per hour dual; from £2/10/- solo; instrument flying, instructors' and advanced courses. Attractive clubhouse with full catering facilities.—Tel.: Nutfield Ridge 2245. [0347]

LEARN to fly at Elstree Flying Club, M.C.A. approved 30-hour courses. Three guineas per hour.—Tel.: Elstree 3070. [8314]

HERTS and ESSEX AERO CLUB, Broxbourne Aerodrome, Nazeing, Essex. M.C.A. approved 30-hour course; solo flying from 30/- per hour; residential; trial lessons, 25/-; train from Liverpool Street, or Green Line Coach 715. Tel.: Hoddesdon 2643, 2441, 3708. [0230]

### CONSULTANTS

WING COMMANDER R. H. STOCKEN, F.R.Ae.S., Eagle House, 109, Jermyn St., London, S.W.1. Tel.: Whitehall 8885. [0419]

CANADA-Gt. Britain liaison service. Technical and sales. Personal contact.—W. P. Dunphy, Consulting Air Engineer, Montreal Airport, Montreal, Canada. [8340]A

### HANGARS

FOR Sale, Hangar (all steel), 113 ft clear span by 135 ft long by 25 ft clear height at eaves, rising to 35 ft clear at apex. Doors each end (stable optional).

HANGAR (all steel), 80 ft clear span by 144 ft long by 22 ft clear height at eaves, rising 32 ft at apex. Doors one end.

STEEL building, 80 ft clear span by 144 ft long by 22 ft clear height at eaves. Large sliding doors in sides.

CURVED steel building, 35 ft span by 17 ft 6 in. high at apex. Up to 600 ft long (low price).

BELLMAN HANGARS, Ltd., Terminal House, London, S.W.1. [8200]


# INCREDIBLE

though it may seem, there IS an organisation which can supply your complete aircraft and airfield requirements. But, if possible, let us forget for a moment our Instrument, Aircraft, Engine and Electrical Divisions and consider solely our Radio Activities.

How else could we describe our Aircraft Radio Division than by stating that we have a large and extremely experienced Sales Organisation backed and strengthened by a superb technical staff who simply delight in dispensing first-class technical advice and assistance for the benefit of the world at large and in overhauling and releasing your aircraft radio to the specifications of the A.R.B. or A.I.D., as required.

Our technical library and essential register of all stock holdings enables us to answer immediately the trickiest question or to let you know whether your particular requirement is held in stock—if so—delivery and price. A tremendous diversity of radio material is currently being demanded from our Organisation. To mention but a few, there are complete radio and radar installations of every conceivable type, all manner of components from the smallest imaginable condenser and resistance to the vast radio valves utilised in high-powered airfield transmitters. Remember, that with our Overhaul Organisation close at hand, we are able to check every item prior to despatch and, beyond that extra service, we are able to tailor sets of radio and radar harness to our clients' own peculiar requirements.

These are but a few of the activities created to assist YOU, so PLEASE remember that when your headache is in connection with radio, the cure is a telephone call or cable to Aerocontacts. . . .

AEROCONTACTS
Limited
GATWICK AIRPORT, HORLEY, SURREY
TELEPHONE HORLEY 1510 CABLES AEROCON HORLEY


### INSURANCE

ALL types of aircraft insurance and personal accident cover. Apply to J. W. T. Emery, Messrs. R. J. Moffat and Co., Percy House, 796, High Rd., Tottenham, N.17. Tel.: Tottenham 2000-4-5. [0586]

### MISCELLANEOUS

GEARLESS automobile developed on aircraft lines by engineer who would meet aero magnate re production. —R.S.V.P. C. J. Robins, Frederick Place, Yeovil. [8041]

SWISSAIR Navirazor, the all-purpose rapid computor used by flying men everywhere, 14/6/-.—Obtainable from Hudes Merchandising Corpn., Ltd., 82, Gloucester Place, London, W.1. [8319]

### PACKING AND SHIPPING

R. AND J. PARKS, Ltd., 143-9, Fenchurch St., E.C. Tel.: Mansion House 3063. Official packers and shippers to the aircraft industry. [0013]

### PATENTS

ENGINEER, well acquainted with nautical works staffs, is requested to sell a British patent.—Write to: Cornillon André, 20bis Cours Richard-Vitton, Lyon (France). [8346]

### PHOTOGRAPHY

FAIRCHILD cameras K24, K20, K19, K8A-B, brand new, E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [0294]

### RADIOS

IF you want to sell your aircraft radio equipment, why not contact Aerocontacts, Ltd., Gatwick Airport, Tel.: Horley 1510, Ext 23. [0098]

AVAILABLE: BC375E, BC191, BC624, SCR88A, R1155, T1154, TR45A, T1000, T1133H, T1469B, T113L, T2801, also alternators, 1,500 cycles, 80 V., 25 A. E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [8295]

### TIME RECORDERS

STAFF item checking and job-casting time recorders (all makes) for quick cash sale; exceptional condition. —Box 7241. [0040]

### TUITION

AIR SERVICE TRAINING
OF
HAMBLE

announce the introduction of a new course in

SPECIALISED SUBJECTS OF
AERONAUTICAL ENGINEERING

COURSE No. 10: ONE YEAR'S DURATION
The course is comprised of four separate phases:

AIRCRAFT MATERIALS
PHYSICAL TESTING OF
AIRCRAFT ACCESSORIES
ELECTRONICS
AERODYNAMICS

Each phase is of three months duration and may be taken separately.

ENQUIRIES invited from:

(1) Experienced engineers interested in qualifying for licences in categories B and/or D.
(2) Ex-A.E.T. students who have completed course.
(3) A.E.I (for which special fees will be quoted).
(4) Candidates interested in any of the specialist subjects.

FIRST course commences on June 30th, 1952. Tuition fees and further intake dates will be advised on application. Residential facilities available. Enquiries to the Commandant, Air Service Training, Ltd., Hamble, Southampton. [8351]

NORTH GLOUCESTERSHIRE TECHNICAL COLLEGE
CHELTENHAM
HIGHER NATIONAL DIPLOMA COURSE
IN AERONAUTICAL ENGINEERING

APPLICATIONS are now invited for enrolment in the above full-time "sandwich" course which will commence in September, 1952.

PART of each year must be spent in industry. The minimum age at entry is 18 years, and the course is open to those holding:

(a) An Ordinary National Certificate; or
(b) An Ordinary National Diploma; or
(c) A General Certificate of Education at advanced level which includes the subjects of mathematics and physics.

APPLICATION forms and further particulars to be obtained from:

THE PRINCIPAL,
NORTH GLOUCESTERSHIRE TECHNICAL COLLEGE,
LANSDOWN ROAD,
CHELTENHAM, GLOS. [8310]

LONDON SCHOOL OF AIR NAVIGATION (1946), Ltd.

PERSONAL coaching for Commercial Instrument Rating, Senior Commercial, A.L.T.P. (conversion courses) and Flight Navigator licences. This school provides the most rapid and economical method of qualifying. I.C.A.O. standards.

COMPLETE "Study-as-you-work" courses. Simulates classroom instruction; lessons, questions, model answers. Unique in application, ideal those employed or seeking career from Services.

I.R.N. instruction and R/T for all instrument rating procedures. Any form of flying training at best quotations.—Brochure with terms: 9-10, King Street, London, W.6. Tel.: Riv. 7493. [0277]

AIRCRAFT engineer "A" and "C" licences, 2-year approved course.

COMMERCIAL pilots and A.L.T.P. technical instruction for general and type rating, conversions, etc.

DIPLOMA course combines full day workshop and technical training for executive appointments.

SYLLABUS from College Secretary, College of Aeronautical and Automobile Engineering, Chelsea, S.W.3. Flaxman 0021. [0019]

LEARN to fly for £24; instructors' licences and instrument flying for £3 an hour; night flying £2/10/- an hour, residence 5 gns. weekly. Approved M.C.A. private pilot's licence course.—Wiltshire School of Flying, Ltd., Thruxton Aerodrome, Andover, Hants. [8350]

### TUITION

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "no pass, no fee" terms; over 90% successes. For details of exams and courses in all branches of aeronautical work, navigation, mechanical eng., etc., write for 144-page handbook free.—B.I.E.T. (Dept. 702), 17, Stratford Place, London, W.1. [0107

FREE! Brochure giving details of courses in all branches of aero eng. covering A.F.R.Ae.S., M.C.A. exams., etc. We are the only postal training college operated by an industrial organization.—Write to E.M.I. Institutes, Postal Division, Dept. F.26, 43, Grove Park Road, London, W.4. Tel.: Chiswick 4417. (Associated with H.M.V.). [0926

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL, Essex. Tel.: Rochford 36264. Comprehensive training for private, commercial licences and instructor's endorsements. M.C.A. approved for 30-hour course. Tiger Moth and Auster aircraft fitted with radio. Special facilities for training in instrument ratings. Hourly rates: solo, day £3, night £4. Dual 5/- extra. Contract rate £2.10/-. Link trainer 10/-. No fees or subscriptions. Trial lesson, 30/-. [0332

AVIGATION, Ltd. (the Safe Guidance and Handling of Aircraft in the Air), 30, Central Chambers, Ealing, London, W.5. Tel.: Ealing 6040. The most up-to-date and fully comprehensive postal and direct tuition is offered for private and professional pilots' licences, including Flight Navigator. Courses, diagrams and photographs are presented in up to six colours and closely follow the syllabuses as laid down by I.C.A.O. and M.C.A. (June, 1952). Papers marked and guidance answers supplied, also facilities for direct tuition on single subjects.

SUCCESSFUL candidates at first attempt—examination fees paid by Aviation, Ltd. [0348

### SITUATIONS VACANT

*The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.*

ROYAL NAVY

YOUNG men between 17 and 24 years are required for short service commissions in the Royal Navy for 8 years' flying duty as pilots or observers. Up to 20 per cent of those completing the engagement will, if suitable, be given permanent commissions. The remainder will pass to the Reserve for 7 years and be paid a tax-free gratuity of £1,500. Applicants must have School Certificate with a pass in mathematics or a General Certificate of Education with passes at ordinary level, in English language, mathematics and one other subject, all taken at one sitting, or equivalent educational qualifications, and be physically fit.

WRITE to Secretary of the Admiralty (C.W.520F), Queen Anne's Mansions, London, S.W.1. [8184

VICKERS-ARMSTRONGS, Ltd. (Aircraft Section), have vacancies at Hurn Depot for the following staff:—
AIRCRAFT STRESSMEN
DESIGN DRAUGHTSMEN
(aircraft experience preferable but not essential)
JIG AND TOOL DRAUGHTSMEN
(aircraft experience preferable but not essential)
FLIGHT TEST OBSERVERS
(experienced on modern aircraft)
JUNIOR STRUCTURAL DRAUGHTSMAN
(Works Engineer's Department)
APPLY, in writing, to the Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge, Surrey. Applications with certain exceptions, are subject to the approval of the Ministry of Labour and National Service. [8317

REQUIRED for large factory in S.E. England:
(a) Engineer with experience of the testing and maintenance of aircraft gyroscopic and servo equipment. H.N.C. standard of education.
(b) Two engineers with experience of the testing and maintenance of airborne electronic equipment. For one post, experience of servo-mechanisms would be an advantage; for the other, experience of radio transmitter-receivers. Must have H.N.C.
(c) Engineer with experience of the testing and maintenance of aircraft hydraulic systems and actuators. H.N.C. desirable.
WRITE, Box F.351, at 191, Gresham House, E.C.2. [8182

HANDLEY PAGE, Ltd., have vacancies for:
AERODYNAMICISTS of degree standard or with H.N.C. in aero subjects. Previous experience preferred.
STRESSMEN of degree standard or with H.N.C. in aero subjects. Previous experience preferred.
SENIOR design and intermediate draughtsmen, preferably with aircraft experience, for Cricklewood and Radlett offices. Considerations will be given to applicants with experience in light structural or mechanical engineering. Possession of O.N.C. or H.N.C. (Mech. or Elect.) an advantage.
WEIGHT control engineers, with O.N.C. (Mech.). Previous experience preferred.
TECHNICAL assistants of degree or H.N.C. (Elect.) standard for the testing and development of aircraft electrical systems. Previous experience preferred.
SENIOR and junior assistants of degree or H.N.C. standard for the Mechanical and Structural Test Dept. at Radlett. Write, stating age, qualifications and details of experience, to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.9. [8231
THE BRISTOL AEROPLANE Co., Ltd., have vacancies in their London Aircraft Design Drawing Office for senior and intermediate draughtsmen.
APPLICATIONS should be forwarded to the Ministry of Labour and National Service, 20, Nelson Street, Bristol, and marked for the attention of the Personnel Manager, The Bristol Aeroplane Co., Ltd., Aircraft Division, Filton House, Bristol. [8271
THE DE HAVILLAND AIRCRAFT Co., Ltd., Airspeed Division, Christchurch Aerodrome, Hampshire, require the following personnel:—
AERONAUTICAL engineers qualified to carry out investigation on defect reports of service aircraft and equip for the preparation of repair schemes and manuals. Saturday or Sunday interview can be arranged.
APPLY to the Personnel Manager at the above firm. [8320
SENIOR design and intermediate draughtsmen required on aircraft and armament projects.—Apply Box 0788. [8267
WANTED link trainer instructor with some knowledge of Air Traffic Control. Apply C.F.I., Airwork Ltd., R.N.A.S., St. Davids, Pembs. [8336
WANTED, Flying instructor with Mosquito experience. Apply C.F.I. Airwork Ltd., R.N.A.S., St. Davids, Pembs. [8337
LICENSED engineers required for light aircraft; maintenance and C. of A. work, single or double licence. Nightingale Aircraft, Denham. [8338


# AEROSERVICES

## OFFER

**ENGINES:**

Cheetah X.
Gipsy Ma or I.
Blackburn Cirrus III.
Pratt & Whitney R.985, R.1830, R.2000 & R.2800

ALL Zero since overhaul.
Pratt & Whitney 1340—spares.

**AIRCRAFT:**

D.H. Doves (2)
Douglas C.47 (1)
Douglas C.54 (1)
Curtiss C.46 (Freighters) (6)
Lockheed 18 (2)
Liberator LB-30 (2)
Constellation 749A Standard (1)
(Lend-Lease-Hire)
Boeing Stratoliner (1)
Consul (1)
Anson (1)
Rapide (1)
Proctor (4)
Auster (2)

***DETAILS of the above aircraft will be despatched to Principals on application***

# AEROSERVICES

**36 Boulevard Haussmann, Paris, 9e.**
*Tel.: Provence 9078. Cables: Aeropaul, Paris*

**46 Hertford St., Park Lane, London, W.1**
*Tel.: GROsvenor 8383. Cables: Aeropaul, London*



# Aero & Jig & Tool Draughtsmen in Great Demand

*MEN & YOUTHS*

There is an insatiable demand for Aero, Jig and Tools, etc., Draughtsmen and Inspectors. So acute is the present shortage that employers are only too anxious to engage those with no previous practical experience who are able to prepare neat and accurate drawings.

**QUALIFY AT HOME—IN SPARE TIME**

After brief, intensely interesting study—undertaken at home in your spare time—YOU can secure an attractive and interesting post as **Aero-Draughtsman.** Numerous vacancies are also available in **Electrical, Mechanical, Plastics,** etc., branches of Draughtsmanship.

**FREE GUIDE**

The Free Guide contains 132 pages of information of the greatest importance to those seeking such success-compelling qualifications as **A.M.I.Mech.E., A.F.R.Ae.S., A.M.I.P.E., A.M.I.M.T., Gen. Cert. of Educ.,** and **B.Sc.,** etc., also **R.A.F. Entry** (Maths., etc.), together with particulars of our remarkable guarantee of

**SUCCESS—OR NO FEE**

*Write now for your copy of this remarkable publication. It may well prove to be the turning point in your career.*

**NATIONAL INSTITUTE OF ENGINEERING**

**(Dept. 427), 148-150, HOLBORN, E.C.1**
*(South Africa Branch E.C.S.A., P.O. Box 8417, Johannesburg).*


### SITUATIONS VACANT

APPLICATIONS are invited for the following staff vacancies in the Aeronautical Division of Marconi's Wireless Telegraph Co., Ltd., Chelmsford.
REF. 976. Project engineers. Applicants should have considerable experience in the drafting of technical requirements and specifications, with a minimum of three years' experience in this work in military or civil aviation fields and only candidates so qualified need apply. University degree-holders or graduates of I.E.E. are preferred. The posts are highly responsible, and applicants are expected to be capable of carrying out technical liaison duties with Government departments and airline organizations.
REF. 968. Engineer for work on aircraft radio installation design. Applicants should be able to produce evidence that they have had at least three years' experience of actual design work in this field and should possess a Higher National Certificate as a minimum qualification.
REF. 879. Sales and contracts engineers. Applicants should possess a sound academic background and be in possession of a University degree or similar qualification, together with practical experience in either ground-based aeronautical communication equipment and navigational aids or airborne radio equipment. It is essential that applicants should have commercial aptitude.
THESE posts are permanent and pensionable. Good starting salaries are offered, depending on experience and qualifications. Applications will be treated as confidential. Please write, giving full details of qualifications and experience and quoting appropriate reference, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham Street, London, S.W.1. [8324
METALLURGIST, preferably with good degree or equivalent, required to lead metallography section of works laboratory, dealing with ferrous and non-ferrous materials.
APPLICATIONS, stating age, qualifications, and details of experience, should be addressed to the Personnel Manager, The Bristol Aeroplane Co., Ltd., Aircraft Division, Filton House, Bristol. [8301
AIR SERVICE TRAINING, Hamble, require the services of a ground instructor, capable of lecturing on the following subjects up to the commercial pilot's licence standard:
AERODYNAMICS/principles of flight, aircraft loading, aircraft instruments, propellers, engine, air and ground handling, air frame construction.
APPLY to the Commandant, Air Service Training, Hamble, giving full details of experience. [8332
LICENSED aircraft engineer required. "A" and "C" licences with endorsement for Auster aircraft essential. —Write, stating full details of experience and personal particulars, to Box 0967. [8318
GENERAL radio engineer and radio mechanics at our base at Stansted Airport, Essex.—Apply, by letter or telephone, to the Senior Radio Engineer, Aviation Traders, Ltd., Southend Airport, Essex. Tel.: Rochford 56491. [0950
PILOT/INSTRUCTOR: Rapide, Auster, Tiger. Permanent post. Accommodation available.—Apply: Manager, The Yorkshire Aeroplane Club, Sherburn-in-Elmet, Yorks. [8261
THE BRISTOL AEROPLANE Co., Ltd., have vacancies in their Aircraft Design Drawing Office for loftsmen with aircraft experience; also experienced linesmen for work on lofting (lithographic process).
APPLICATIONS should be forwarded to the Ministry of Labour and National Service, 20, Nelson Street, Bristol, and marked for the attention of the Personnel Manager, The Bristol Aeroplane Co., Ltd., Aircraft Division, Filton House, Bristol. [8291
PORTSMOUTH AVIATION have vacancies for stressmen of all grades for super-priority work at Portsmouth and Hurn Airports.—Apply: The Airport, Portsmouth. [8151
APPLICATIONS are invited from senior and junior stressmen and draughtsmen for work on new designs. Applications should state age, experience, qualifications and salary expected.—Auster Aircraft, Ltd., Rearsby Aerodrome, Leics. [8308
WEIGHT estimator required by Percival Aircraft, Ltd., Luton Airport, Beds., for work on fixed wing and helicopter aircraft.—Apply, giving details of age, qualifications, experience and salary required, to: Manager, Ministry of Labour and National Service, Luton, Beds. [0692
AIRWORK, Ltd., require ex-R.A.F. flying instructors, preferably with ab initio experience, for duties in the north of England. Applicants should possess a minimum B.I. category.—Apply: Chief Instructor, Airwork, Ltd., R.A.F. Station, Digby, Nr. Sleaford, Lincs. [8296
TECHNICAL assistant, H.N.C. standard, and of British nationality, required for interesting and varied work in modern mechanger test laboratory.—Apply in writing to Chief Designer, Delaney Gallay, Ltd., Edgware Road, Cricklewood, N.W.2. [8288
WEIGHTS engineers to work on fixed and rotating-wing aircraft are required by Saunders-Roe, Ltd. Good conditions and prospects. Salary according to age and experience.—Please forward full details to the Cowes Office of the Ministry of Labour and National Service. [8270
ASSISTANT chief stressman required by Percival Aircraft, Ltd., Luton Airport, Beds.—Applications, giving full details of qualifications, experience, age and salary required, to the Manager, Ministry of Labour and National Service, Luton. [0598
SERVICE engineers required by The de Havilland Engine Co., Ltd.—Written applications only, stating age and previous experience, to the Personnel Officer, The de Havilland Engine Co., Ltd., Leavesden Aerodrome, nr. Watford, Herts. [8346
TECHNICAL authors and illustrators required by Percival Aircraft, Ltd., Luton Airport, Beds. Knowledge of M.o.S. procedure desirable.—Applications, in writing, stating age, experience and salary required, to the Manager, Ministry of Labour and National Service, Luton, Beds. [0594
DEPUTY chief engineer required for service in the Newcastle area. Applicants, preferably with R.A.F. experience, should be licensed on Proctor aircraft.—Apply: Flying Training Division, Airwork, Ltd., Sutton Lane, Langley, Slough, Bucks. envelopes to be marked "Flying Training." [8327
TEST laboratory assistants (male) required by Percival Aircraft, Ltd., Luton Airport, Beds. National Certificate standard and previous experience on design of test laboratory equipment desirable.—Applications, stating qualifications, experience, age and salary required, to Manager, Employment Exchange, Luton, Beds. [0596
AIRWORK GENERAL TRADING Co., Ltd., urgently require "X" licenced electricians for maintenance and overhaul of electrical equipment installed in Hermes and Viking aircraft.—Applications, in writing, to the Service Manager, Airwork General Trading Co., Ltd., Blackbushe Airport, near Camberley, Surrey. [8328
A WELL-KNOWN firm of aircraft instrument manufacturers requires a designer draughtsman to complete a small development section. He will be required, with assistance, to produce complete drawings at all stages from initial design to production of a new type of equipment. Experience in light engineering work is necessary, but electrical experience is not essential. Guildford area. —Apply, giving particulars of qualifications and experience, to Box 1037. [8343

**GLOSTER AIRCRAFT**
**CO., LTD.**
**HUCCLECOTE · GLOUCESTER**

The following **VACANCIES** exist on progressive projects of advanced interest:—

**STRESSMEN**
Senior and Intermediate.
**WEIGHTSMEN**
Senior and Junior.
**DRAUGHTSMEN**
Structural and Electrical.

*Previous aircraft experience an advantage but not essential*

Prospects are excellent for energetic and sound applicants

APPLICATIONS to be addressed to the **CHIEF DESIGNER** giving particulars of **Experience, Age and Salary**

**AUTOMOBILE ENGINEERING FIRM OF REPUTE IN NORTH WESTERN AREA HAVE IMMEDIATE VACANCIES FOR DETAIL DRAUGHTSMEN BETWEEN THE AGES OF 21 AND 25 YEARS OF AGE**

THESE VACANCIES OFFER GOOD TERMS AND CONDITIONS, ALSO EXCELLENT PROSPECTS FOR RIGHT TYPE OF APPLICANTS

*Apply immediately to Box No. 119, c/o Flight, giving as many particulars as possible regarding experience etc.*

**AIRCRAFT SPRING WASHERS**

TO B.S. SPECIFICATION S.P. 47

CROSS MFG. (1938) LTD., COMBE DOWN, BATH


## SITUATIONS VACANT

REQUIRED immediately by Percival Aircraft, Ltd., Luton Airport, Beds., several draughtsmen with comprehensive experience of engine installations and allied systems.—Applications, in writing, stating age, qualifications, experience and salary required, to the Luton Employment Exchange. [0601]

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0450]

LANCASHIRE AIRCRAFT CORPORATION, Ltd., Ringway Airport, Herts, require qualified pilots, navigators and radio officers for their York fleet. Only applicants holding appropriate M.C.A. licences will be considered.—Please write full details to the Personnel Manager, at above address. [0290]

AIRWORK Ltd., require staff pilots for duties on Mosquito aircraft at Hurn Airport. No civilian licences necessary.—Applicants, who should have previous R.A.F. or R.N. Mosquito experience apply, Airwork Ltd., Flying Training Division, Sutton Lane, Langley, Bucks, envelopes to be marked "Flying Training." [0539]

SENIOR engineer to take charge of a testing and inspection department for airborne ancillary equipment. Familiarity with electronic servomechanisms and gyroscopic devices essential. Practical flying experience an advantage. Applicants should preferably possess a degree or equivalent professional qualification.—Write Pers/F.278, at 191, Gresham House, E.C.2. [0225]

INTERNATIONAL AERADIO, Ltd., require radio/radar mechanic experienced in maintenance of radio-sonde and raywind ground equipment for service in Khartoum. Salary from £841 to £1,132, according to marital status, tax free. Quarters are provided. Paid U.K. leave annually. Free passages. Pension fund. Kit allowance.—Write, quoting ET, Personnel Officer, 40, Park Street, W.1. [0329]

GUIDED WEAPONS development offers good opportunities for senior and junior electronic, electrical, radio and mechanical engineers and draughtsmen, aerodynamicists, trials observers, technical authors, and computors (female); also for skilled and semi-skilled fitters, electronic wiremen, toolmakers and machine tool operators.

APPLY, quoting Reference S.P. and giving particulars, qualifications and experience, to the Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge, Surrey. [0534]

HANDLEY PAGE, Ltd., require a technical assistant of degree or H.N.C. standard to carry out work on thermo-dynamic problems for aircraft air-conditioning and thermal de-icing systems.—Write, stating age and giving particulars of qualifications and experience, to Staff Officer, Handley Page, Ltd., Claremont Road, London, N.W.2. [0210]

PLANNING engineer (aircraft) required by Percival Aircraft, Ltd., Luton Airport, Beds. Considerable practical experience of manufacture of metal airframe components and production planning essential qualifications.—Apply to Manager, Employment Exchange, Luton, giving full details of age, qualifications, experience and salary required. [0597]

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen, and stressmen, for work on this interesting programme.—Write, giving details of experience and salary required, to Manager, Ministry of Labour and National Service, Luton, Beds. [0586]

ENGLISH ELECTRIC CO., Ltd., Luton, have vacancies for a technical publications engineer and technical artist. Previous experience is essential. Please write, giving full details of qualifications and experience and quoting ref. "English Electric 986," to Westminster Employment Exchange, Chadwick Street, London, S.W.1. [0334]

APPLICATIONS are invited from senior and intermediate design draughtsmen. Experience of aero-engine design desirable, but not essential. Also checkers. —Please write, stating age and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0930]

APPLICATIONS are invited from design draughtsmen and stressmen, also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.—Applications should state full particulars of experience and qualifications and should be addressed to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0932]

HANDLEY PAGE (Reading), Ltd., The Aerodrome, Woodley, Reading, have vacancies in their design office for senior aircraft draughtsmen both electrical and airframe, also for a weights engineer with at least two years' experience. These positions are progressive and offer good scope for advancement to the right men.—Please send full particulars to the Personnel Officer or apply through your Local Employment Exchange. [0574]

A TECHNICAL writer is required by a firm of aircraft instrument manufacturers for preparation of installation, maintenance and overhaul manuals and other publications for instrument installations and complete systems. Experience of aircraft installations and electrical equipment is essential. Some previous experience in this type of work would be an advantage. Guildford area.—Write, giving full details of experience, etc., to Box 0997. [0326]

ARMSTRONG SIDDELEY MOTORS have a few vacancies for senior and junior stressmen to do work on strength investigation and calculations on gas turbine aero engines. Degree, Higher National certificate or equivalent essential. This is work of prime national importance. There are also a few vacancies for senior and junior stressmen for work on the installation of gas turbines in aircraft.—Reply in some detail to Reference SJS.2, Armstrong Siddeley Motors, Ltd., Coventry. [0242]

FLIGHT REFUELLING, Ltd., require a junior assistant in their technical office. Minimum qualification, H.N.C. (Mech.); age, 22-25. Interesting programme of test and development work on hydraulic components and systems, and testing of aircraft materials. Salary, £450-£550.—Please write, giving full details of age, qualifications, experience and salary required, to Personnel Manager, Tarrant Rushton Airfield, Nr. Blandford, Dorset. [0260]

DE HAVILLAND ENGINE Co., Ltd., have the following technical vacancies available in the Experimental Test Beds Department of their Hatfield factory. Junior technical assistants required for test work in connection with recording and analysing the performance data of development gas turbine engines. Good salaries to suitable applicants. Canteen facilities, five-day week.—Please write, giving age, full details of previous experience and salary required, to the Personnel Officer, The de Havilland Engine Co., Ltd., Hatfield Aerodrome, Hatfield, Herts. [0313]


**THE DE HAVILLAND AIRCRAFT CO. LTD.**

*have vacancies for*
SENIOR AND INTERMEDIATE DESIGN DRAUGHTSMEN in their HATFIELD and LONDON OFFICES

*Men with experience in*
STRUCTURES DESIGN
MECHANICAL DETAILS
ELECTRICAL INSTALLATIONS
*are invited to apply*

Aircraft experience preferred but applications will be considered from men experienced in light Mechanical Engineering or Wiring Layouts, Design of Electrical Junction Boxes, etc.

Large programme of work on CIVIL JET AIRLINERS AND MILITARY AIRCRAFT

*Apply in writing to*
The Chief Draughtsman,
THE DE HAVILLAND AIRCRAFT CO. LTD.,
Hatfield, Herts.

*Applications are subject to approval of Ministry of Labour and National Service*

**REQUIRED IMMEDIATELY BY WELL KNOWN AUTOMOBILE ENGINEERING FIRM IN NORTH WEST DISTRICT**

*Designers and Detail Draughtsmen, Jig and Tool Draughtsmen—also Planning Engineers*

THESE VACANCIES OFFER GOOD CONDITIONS AND PROSPECTS TO SUITABLE APPLICANTS. SALARY ACCORDING TO AGE, EXPERIENCE AND QUALIFICATIONS

Apply Box No. 8013, c/o Flight

**COTTON BAGS**
FOR SPARE PARTS, etc.
**WALTER H. FELTHAM & SON, LTD.**
Imperial Works, Tower Bridge Road,
Telephone: HOP 1764 LONDON, S.E.1

**SITUATIONS VACANT**

ARMSTRONG SIDDELEY MOTORS, makers of two out of three of England's Super Priority jet engines, have number vacancies Coventry for experienced planning engineers. Aero engine experience great advantage, general engineering experience possibly sufficient if combined with high level intelligence. Also vacancies for factory layout draughtsmen and senior and intermediate tig and tool draughtsmen. Reply in detail to reference HDT Box 1014. [8222

SENIOR technical assistant required for the Service Department of the de Havilland Engine Co., Ltd., preferably with experience on reciprocating and gas turbine engines. Suitable applicants will be required to work on Headquarters' staff of the Service Department at Leavesden Aerodrome, near Watford, Herts.—Apply in writing, stating age qualifications and salary required, to the Personnel Officer, The de Havilland Engine Co., Ltd., Leavesden Aerodrome, near Watford, Herts. [8201

MATHEMATICIANS and physicists with a special interest in theoretical problems are required by the English Electric Co., Ltd., for their Luton establishment. Applications are invited from Senior men with Honours Degree and industrial experience, and graduates (male and female) who have recently left university.—Please write, giving full details of qualifications and experience and quoting reference 441H, to Central Personnel Services, 24-30, Gillingham Street, London, S.W.1. [8235

OPPORTUNITY exists for a licensed instructor to take over management of progressive flying club in Home Counties. The club has all amenities, i.e. restaurant, bar, recreation rooms, etc., and the successful applicant would be required to supervise and control all club activities. He must be a man of initiative, able to work without supervision. Accommodation would be provided in very pleasant surroundings. A private pilot's licence holder with an instructor's endorsement would be considered for this post. The position is available immediately and applicants are requested to write, giving full particulars in the first instance, when interviews will be arranged immediately.—Eagle Aviation, Ltd., 20, Clarges Street, London, W.1. [8312

AERONAUTICAL service engineer required. Duties will include installation, flight testing and servicing, for which a thorough practical and theoretical knowledge of a.c. and d.c. amplifier systems is required. A knowledge of electro-mechanical servo systems and synchronous transmission systems would be an advantage. Preferential consideration will be given to applicants with previous electronic experience in possession of H.N. Certificate (or equivalent), or who have served a recognised engineering apprenticeship with subsequent experience in a technical capacity. Must be prepared to travel. Position will be permanent and pensionable after qualifying period. Commencing salary £450 p.a. Apply with full details of age, qualifications and experience to:—Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Rd., Brentford, Middlesex. [8331

**SITUATIONS VACANT**

ENGLISH ELECTRIC Co., Ltd., Luton, require senior and junior designers, capable of working with a minimum of supervision on design and development of hydraulic components, pneumatic components and aircraft fuel systems. Higher National Certificate or equivalent with practical and drawing office experience essential. Excellent prospects for advancement on a project of the highest priority. Salary £450 to £800, according to age, qualifications and experience. Suitable candidates without the specialized experience stated will be considered as trainees.—Please write, giving full details and quoting Ref. 491C, to Central Personnel Services, 24-30, Gillingham Street, London, S.W.1. [8349

**SITUATIONS WANTED**

PILOT (28), ex-R.A.F. Approx. 1,000 hours, singles, twins and jets, no licences. Keen to make career as civil pilot. Any offer of employment or advice welcomed.—Box 0999. [8315

AIRLINE captain, age 38, 6,000 hours, Vikings, D.C.3, D.C.4, D.C.6, Scandinavian A.L.T.P., British Commercial at present, requires job home or abroad, flying if possible. Would consider partnership charter or aerial work company.—Box 1038. [8345

**BOOKS, ETC.**

FOR sale, "Jane's Aircraft, 1945-6," old aviation material: rail, motor cars.—Box 0988. [8309

accurate
torque
loading

The ACRATORK spanner is fully automatic. It can be used by unskilled labour with precision results. With ACRATORK it is impossible to exceed the pre-set torque load and its accuracy is unaffected by side loads. 8 standard models to suit a wide range of applications for loads up to 250 lbs./ft. Larger models supplied to special order.

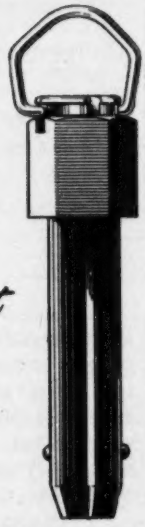
ACRATORK
MARK VI PRECISION TORQUE SPANNER

WORLD PATENTS APPLIED FOR

WORLD DISTRIBUTORS
CORY BROTHERS & CO. LTD.
Corys' Buildings, Cardiff. Tel: Cardiff 31141

PiP POSITIVE SELF LOCKING QUICK RELEASE REGD. (Fully Patented) PiNS

FOR EVERY LOCK PIN APPLICATION WHERE QUICK RELEASE POSITIVE SELF LOCKING IS AN ADVANTAGE



* Adaptability

The range of sizes is mechanically unlimited. Wherever a locking pin is needed Pip Pins will do the job more quickly—more efficiently—and, in the long run, more economically.

* Simple operation

Only a simple axial movement is needed to engage or release—the other hand is free to support the member being erected or dismantled.

* Positive Engagement

Inserting the Pip Quick Release Pin is as simple as pushing home an ordinary pin or bolt—but once the operating spindle is released the Pin is automatically and positively locked.

* Self Contained

The patented internal locking system obviates the need for any further locking device—a great boon under cold, wet conditions or in confined spaces.

AVIATION DEVELOPMENTS LTD.
Kingsbourne House, 229-231, High Holborn, London W.C.1.
Tel.: CHAncery 8601 (8 lines)

STEEL BUILDINGS for DISPOSAL

**Structure.** 100'×48'×14' high.
Asbestos roof and sides. 6' glazing in roof slopes.

**Storage Building.** 180'×90' in three 30' bays × 14' high.
New cladding and ¼" P.G. in roof slopes.

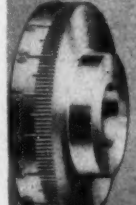
**Crane Building.** 226'×55' span × 27' high.
With 5 ton O.E.T. crane 400/440V. Steel sliding doors, gutters, etc.

**Single Storey Building.** 192'×42'6"×14' high. Ready for erection.

*These buildings can be supplied and erected complete*

CHAMBERLAIN INDUSTRIES LTD.
STAFFA ROAD, LEYTON E.10
Telephone: LEYtonstone 3678

All classes of
MACHINE ENGRAVING
from
SIMPLE DIALS
to
INTRICATE DIES



JOHN MEERLOO & SONS LTD.
74 LONDON RD., KINGSTON-ON-THAMES
ON A.I.D. APPROVED LIST NO. 4862/50


Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London and Watford, Herts. Flight can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.: Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.

## We don't cast in doubt . . .

## at T. I.

We prefer certainty. In the foundry, all sporting chances are out. Before casting our aluminium billets and slabs, every melt is sampled, *and within two minutes we have a complete analysis, showing the exact percentage of all constituents.* Anything wrong we correct then and there—with time to check again by yet another analysis before pouring.

This swift accuracy in testing has been made possible by an electronically controlled spectrographic apparatus called a *Quantometer*. Made for us by Applied Research Laboratories in California, it is the only instrument of the kind in this country. It enables us to send a billet to the extrusion press or a slab to the rolling mill immediately after casting, with absolute certainty that it is to specification.

A reason the more for saying . . .

PUT Aluminium FIRST
AND TI IN FRONT OF IT

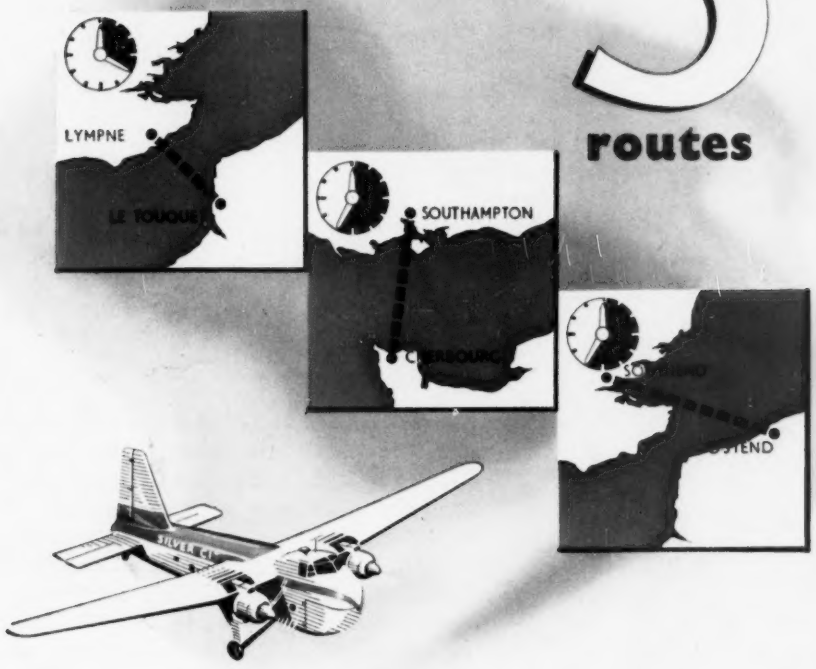
**T. I. ALUMINIUM LTD.**

REDFERN ROAD, TYSELEY, BIRMINGHAM, 11.

*Telephone: Acocks Green 3333.* *A Tube Investments Company*

ALUMINIUM AND ALUMINIUM ALLOY INGOT, SLABS, BILLETS, SHEET, STRIP, TUBES & EXTRUSIONS TO ALL COMMERCIAL A.I.D. & LLOYD'S SPECIFICATIONS

# Car Ferry service on 3 routes




During the past four years, thousands of British motorists, motor-cyclists and pedal-cyclists have made the 20-minutes flight by "Bristol" Freighter from Lympne to Le Touquet. This year, with fares on the Lympne service reduced for the fourth successive year, new services opened by Silver City Airways will bring Ostend within 35 minutes' flight of Southend, Cherbourg within 35 minutes' of Southampton . . . achievements made possible by the exceptional load capacity and operating economy of the "Bristol" Freighter.

THE Bristol AEROPLANE COMPANY LIMITED · ENGLAND

999A